

VU Learning HUB

CS101 Quiz File

Chapter-wise Solved MCQs

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Module 1: Introduction to Computer Science

Q1. What is defined as a set of instructions designed to perform a specific task?

- A) Hardware
- B) Security
- C) Algorithm
- D) Mainframe

Q2. Which component of a computer system is defined as the collection of physical parts, such as the case, monitor, keyboard, and mouse?

- A) Software
- B) Hardware
- C) Firmware
- D) Information processing

Q3. Security controls in computer systems are put in place to provide confidentiality, integrity, and availability for which components?

- A) Only hardware and monitors
- B) Data, software, hardware, and firmware
- C) Only external web pages and search engines
- D) Only keyboards and mice

Q4. What term refers to the manipulation of digitized information by computers and other digital electronic equipment?

- A) Information processing
- B) Algorithm execution
- C) Query formulation
- D) Hardware configuration

Answer Key

C -- An algorithm is defined strictly as a set of instructions designed to perform a specific task.

B -- Hardware represents the collection of physical parts of a computer system, including the monitor, keyboard, and mouse.

B -- Security controls provide confidentiality, integrity, and availability for data, software, hardware, and firmware.

A -- Information processing refers to the manipulation of digitized information by computers and digital equipment.

Module 2: Breadth First Learning

Q1. What learning strategy provides a basic introduction to almost all computer science courses before diving into details?

- A) Depth First Learning
- B) Breadth First Learning
- C) Stepwise Refinement
- D) Recursive Learning

Q2. In Depth First Learning, how is course material covered?

- A) One particular course is first covered in detail before moving to the next course.

- B) All major courses are introduced at an abstract high level simultaneously.
- C) Only practical programming tools like C++ are taught.
- D) Topics are studied without covering any theory.

Q3. How is an algorithm defined in the course topic overview?

- A) A collection of physical parts inside the case
- B) A set of steps in a sequence to perform a certain task
- C) A database schema that extracts information
- D) A web server host running on port 80

Q4. What is the primary purpose of data abstraction in computer science design?

- A) To increase hardware size and memory cost
- B) To hide complexities from the designer and help comprehend things with more ease
- C) To prevent search engines from indexing web pages
- D) To convert text files into machine language manually

Answer Key

B -- Breadth First Learning gives a basic introduction to almost all CS courses to provide the overall bigger picture.

A -- In Depth First Learning, one specific course is covered in full detail before proceeding to the next.

B -- Module 2 defines an algorithm as a set of steps in a sequence to perform a certain task.

B -- Data abstraction hides design complexities so complex systems can be comprehended with greater ease.

Module 3: Search Engines

Q1. What is a query in the context of search engines?

- A) A physical component inside the computer case
- B) The set of words given to the search engine for searching
- C) A programming language compiled by an assembler
- D) An operating system scheduler

Q2. By default, how does Google process terms entered into a standard search query box?

- A) It finds all pages containing all the terms given in the query.
- B) It ignores all words except the first word.
- C) It only searches PDF files on YouTube.
- D) It converts the text into binary machine instructions.

Q3. Which of the following is true regarding capitalization when searching on Google?

- A) Searches must always be typed in uppercase letters.
- B) Capitalization does not make a difference (e.g., "COMPUTER SCIENCE" vs "computer science").
- C) Uppercase letters force Google to search only social media sites.
- D) Lowercase letters cause Google to display a system error.

Q4. What query can be entered into Google if you need to flip a coin without having a physical coin?

- A) "Flip a Coin"
- B) "Head Hurts"
- C) "Weather Lahore"
- D) "Define:Computer"

Answer Key

- B -- A query is strictly defined as the set of words provided to a search engine to search for information.
- A -- Standard Google searches find web pages containing all the terms provided in the query text box.
- B -- Google searches are case-insensitive, so capital and lowercase letters produce identical search results.
- A -- Typing "Flip a Coin" on Google launches an interactive coin-flip tool.

Module 4: Searching Tricks

Q1. How can you check the weather for a specific location directly on Google?

- A) Type the word "Weather" followed by the location name (e.g., "Weather Lahore")
- B) Use the site operator like "site:weather.com"
- C) Type "map:" followed by the city name
- D) Type "allintitle:weather"

Q2. What happens when you type a mathematical calculation like "12*391" directly into the Google search bar?

- A) Google displays an error message asking for text words
- B) Google automatically starts the calculator, evaluates the query, and displays the result
- C) Google searches only for academic papers about multiplication
- D) Google redirects the user to YouTube

Q3. Which query format allows a user to perform a live currency conversion on Google?

- A) "100 euro to pkr"
- B) "stocks:aapl"
- C) "pkr 50000 laptop"
- D) "Define:Euro"

Q4. Besides basic arithmetic, which types of calculations or conversions can be performed directly via Google's search bar?

- A) Trigonometric functions like "Sin 90" and unit conversions like "Kph in Mph"
- B) Compiling C++ programs into machine code
- C) Executing SQL joins across databases
- D) Creating Dreamweaver tables automatically

Answer Key

- A -- Adding a city name after "Weather" brings up Google's direct weather widget.
- B -- Google recognizes mathematical operations, launches its calculator app, and computes the answer automatically.
- A -- Querying "100 euro to pkr" invokes Google's live currency converter widget.
- A -- Google's search bar handles trigonometric functions (like Sin 90) and unit conversions (like Kph in Mph).

Module 5: Search Operators (1)

Q1. Which symbol is added to a query term to search for information on a specific social media platform?

- A) "#" symbol
- B) "@" symbol

- C) "*" symbol
- D) "-" symbol

Q2. How do you exclude unwanted terms from search results on Google (for example, excluding car results when searching Jaguar)?

- A) Enclose the word in double quotation marks
- B) Put a minus sign "-" directly before the word to exclude (e.g., "Jaguar -cars")
- C) Use the "site:" operator
- D) Add an asterisk "*" before the word

Q3. What search technique ensures Google looks for an exact phrase where words appear together in the specified order?

- A) Enclosing the phrase in double quotation marks
- B) Placing a hashtag "#" in front of every word
- C) Writing the phrase in uppercase letters
- D) Adding "pkr" before the phrase

Q4. What character acts as a wildcard operator to substitute an unknown word within a search phrase?

- A) Minus sign "-"
- B) Asterisk "*"
- C) At symbol "@"
- D) Plus sign "+"

Answer Key

B -- The "@" symbol directs Google to search specifically within named social media platforms.

B -- Placing a minus sign "-" immediately before a term excludes pages containing that specific term.

A -- Enclosing a phrase in double quotes forces Google to match the exact string of text in precise order.

B -- An asterisk "*" serves as a wildcard representing any unknown word or placeholder in a quoted phrase.

Module 6: Search Operators (2)

Q1. Which operator allows you to restrict Google search results exclusively to a specific domain or website?

- A) site:
- B) related:
- C) cache:
- D) filetype:

Q2. How do you search for documents of a specific file format, such as PDF files?

- A) Use "filetype:pdf" or "ext:pdf" in the query
- B) Put two dots between the file names
- C) Use the "map:" operator
- D) Put "@" at the end of the query

Q3. Which search operator is used to discover websites that are similar or related to a given URL?

- A) info:
- B) related:

- C) cache:
- D) site:

Q4. What notation is used in Google search queries to specify a range between two numbers or prices?

- A) Two dots "." between numbers (e.g., "pkr25000..pkr35000")
- B) A hyphen surrounded by spaces
- C) An asterisk "*"
- D) The word "AROUND" with parentheses

Answer Key

- A -- The "site:" operator restricts search output exclusively to pages hosted on the specified domain.
- A -- Using "filetype:" or "ext:" filters search results to match specific file formats like PDF or DOC.
- B -- The "related:" operator finds websites with content similar to the target web address.
- A -- Two consecutive dots ".." between numeric values define a numeric or price range search.

Module 7: Search Operators (3)

Q1. Which search operator is used to view stock market trends for a company like Apple?

- A) stocks:
- B) map:
- C) movie:
- D) define:

Q2. What query operator retrieves dictionary definitions for a specific term?

- A) define:
- B) info:
- C) stocks:
- D) intext:

Q3. Which Google feature or web link allows users to perform visual searches using an image as the query?

- A) Google Maps (maps.google.com)
- B) Google Images (<https://images.google.com/>)
- C) Google Stocks (finance.google.com)
- D) W3Schools HTML reference

Q4. What query can be typed into Google to trigger fun visual effects like rotating or slanting the results page?

- A) Tilt
- B) Rotate
- C) Flip a Coin
- D) AROUND(3)

Answer Key

- A -- Typing "stocks:" followed by a ticker symbol (such as "aapl") displays financial stock trends.
- A -- The "Define:" operator fetches dictionary definitions and word explanations.
- B -- Google Images allows users to upload or link an image to search for similar visual content.

A -- Entering "Tilt" in Google activates visual tricks that tilt or rotate the display screen.

Module 8: Advanced Search Operators

Q1. Which advanced operator restricts search results strictly to pages where the query phrase appears in the page title?

- A) Intitle:
- B) inurl:
- C) intext:
- D) site:

Q2. What is the purpose of the "AROUND(n)" proximity search operator?

- A) To find web pages where two terms appear within "n" words of each other
- B) To round numbers up to the nearest integer
- C) To search for websites in surrounding geographical cities
- D) To rotate the browser window by "n" degrees

Q3. Which operator searches for specified terms specifically within the web address (URL) of web pages?

- A) allintitle:
- B) intitle:
- C) intext:
- D) inurl:

Q4. To find non-secure (non-HTTPS) pages of a specific website like YouTube, which combined query is correct?

- A) site:youtube.com -inurl:https
- B) youtube.com +https
- C) allintitle:youtube http
- D) filetype:youtube -https

Answer Key

A -- "Intitle:" restricts Google results to pages having the exact target phrase in their title tag.

A -- "AROUND(n)" performs proximity searches, matching documents where target terms appear within "n" words apart.

D -- "inurl:" filters search results to pages containing the specified query string inside their URL address.

A -- Combining "site:youtube.com -inurl:https" filters for pages on YouTube that lack "https" in their URL.

Module 9: What We Should Not Search on Internet

Q1. What are the primary reasons the handout advises against searching certain sensitive or private topics?

- A) Unnecessary targeted ads, security agency monitoring, and cyber-security/virus risks
- B) Google charges monetary fees for searching sensitive words
- C) Search engines permanently crash when sensitive terms are entered
- D) Hardware components inside the CPU melt

Q2. Why does searching for items like "Free Music" pose a cyber-security risk according to the document?

- A) Hackers frequently attach malicious viruses to such free download websites
- B) It automatically deletes the operating system kernel
- C) It forces Google to convert all text into binary
- D) It prevents the computer monitor from turning on

Q3. Searching for sensitive security-related topics (such as "pressure cooker bomb story" or "how to make explosives") can result in what?

- A) Alerting law enforcement and security agencies to inspect or visit your location
- B) Increasing the processing speed of the CPU
- C) Receiving free hardware upgrades from IBM
- D) Automatically opening Microsoft Excel

Q4. To avoid receiving unwanted targeted advertisements from search engines, which personal information should you avoid searching?

- A) Personal email, medical issues/drugs, personal name, and exact location
- B) Basic math calculations like 12×391
- C) City weather like "Weather Lahore"
- D) Definition of computer

Answer Key

A -- The handout cites unwanted targeted ads, law enforcement monitoring, and virus risks as main reasons.

A -- Free download sites often host malicious code and viruses planted by hackers.

A -- Law enforcement agencies monitor sensitive security queries and may investigate locations conducting such searches.

A -- Searching personal identifiers and health issues generates targeted advertisements based on user profiling.

Module 10: Roots of Computing

Q1. Which early computing device consisted of beads strung on rods mounted in a rectangular frame?

- A) Abacus
- B) Pascaline
- C) ENIAC
- D) Transistor

Q2. Why did Charles Babbage envision mechanical computing machines that would print results on paper?

- A) To eliminate the possibility of transcription errors
- B) To connect directly to the Internet
- C) To run C++ programs
- D) To convert binary to hexadecimal

Q3. Herman Hollerith introduced punched cards to process data for which major event, leading to the founding of IBM?

- A) The 1890 U.S. Census
- B) The invention of the World Wide Web
- C) The development of ENIAC in 1946
- D) The launch of Apple desktop in 1976

Q4. Which early electronic computer was developed by John Mauchly and J. Presper Eckert, occupying 1800 square feet?

- A) ENIAC
- B) Abacus
- C) IBM PC
- D) Pascaline

Answer Key

A -- The abacus is an ancient mechanical device made of beads on rods set in a rectangular frame.

A -- Babbage designed printing mechanisms for his machines to prevent human errors when copying calculations.

A -- Hollerith's punched card tabulating system was developed for the 1890 U.S. Census and paved the way for IBM.

A -- ENIAC was a massive early electronic computer containing 20,000 vacuum tubes built at the University of Pennsylvania.

Module 11: Bits

Q1. What is the basic unit of storage in a computer system?

- A) Byte
- B) Bit
- C) Pixel
- D) Sector

Q2. How many bits are equivalent to 1 Byte?

- A) 4 bits
- B) 8 bits
- C) 16 bits
- D) 1024 bits

Q3. How many different patterns can be represented using a 3-bit pattern?

- A) 4
- B) 6
- C) 8
- D) 16

Q4. According to the bit units hierarchy in the source, how many Megabytes (MB) make up 1 Gigabyte (GB)?

- A) 1000 MB
- B) 1024 KB
- C) 1024 MB
- D) 256 MB

Answer Key

B -- A bit (short for Binary Digit) is the fundamental unit of storage in a computer.

B -- The source specifies that 1 Byte consists of 8 bits.

C -- A 3-bit pattern can represent $2^3 = 8$ distinct patterns.

C -- Under the bit units conversion table, 1 Gigabyte (GB) equals 1024 Megabytes (MB).

Module 12: Boolean Operations

Q1. Boolean operations are named in honor of which pioneer in mathematical logic?

- A) John von Neumann
- B) Alan Turing
- C) George Boole
- D) Charles Babbage

Q2. Which Boolean operation produces an output of 1 ONLY when both inputs are 1?

- A) OR
- B) XOR
- C) AND
- D) NOT

Q3. What is the output of an XOR (Exclusive OR) operation when both input bits are identical?

- A) 1
- B) 0
- C) 10
- D) 11

Q4. In Boolean logic representation, what values do bit 0 and bit 1 represent respectively?

- A) True and False
- B) False and True
- C) 0 and 10
- D) ON and OFF

Answer Key

C -- Boolean operations are named after mathematician George Boole.

C -- The AND operation yields 1 only when both of its inputs are 1.

B -- XOR produces 0 when both inputs are the same, and 1 when inputs differ.

B -- In Boolean operations, bit 0 represents false and bit 1 represents true.

Module 13: Hexadecimal Notation

Q1. What is the primary purpose of using hexadecimal notation in computer systems?

- A) To increase memory capacity
- B) To simplify long bit streams into compact human-readable form
- C) To encrypt data for security
- D) To convert text to audio

Q2. How many bits are grouped together to convert a binary string into a single hexadecimal digit?

- A) 2 bits
- B) 4 bits
- C) 8 bits
- D) 16 bits

Q3. In hexadecimal notation, which letter represents the binary pattern "1110"?

- A) A
- B) C
- C) E
- D) F

Q4. What is the correct hexadecimal representation for the binary pattern "1110 1000 0101 0101 0001 0111"?

- A) E85517
- B) F85517
- C) D85517
- D) E75518

Answer Key

B -- Hexadecimal notation simplifies long bit streams into compact forms that are easier for humans to read.

B -- Bit streams are partitioned into 4-bit groups to map directly to hexadecimal digits.

C -- The binary pattern "1110" represents decimal 14, denoted as 'E' in hexadecimal.

A -- Dividing into 4-bit blocks yields 1110(14=E) 1000(8) 0101(5) 0101(5) 0001(1) 0111(7) = E85517.

Module 14: Storing a Bit

Q1. Which electronic circuit component inside main memory is capable of storing a single bit?

- A) Bus
- B) Flip-flop
- C) Sector
- D) Track

Q2. What is the standard size of a manageable memory cell in a computer's main memory?

- A) 4 bits
- B) 8 bits (1 byte)
- C) 16 bits
- D) 32 bits

Q3. How are bits arranged by convention in byte-size memory organization?

- A) Most significant bits on the left, least significant on the right
- B) Least significant bits on the left
- C) Randomly arranged
- D) In a circular pattern

Q4. What term refers to the unique identifier or "name" assigned to each memory cell?

- A) Address
- B) Pointer
- C) Sector
- D) Track

Answer Key

B -- Main memory consists of electronic circuits like flip-flops, each storing a single bit.

B -- Main memory is organized into cell units of 8 bits (1 byte) each.

A -- Most significant bits are positioned on the left side and least significant bits on the right side.

A -- Each individual cell in memory is identified by a unique address.

Module 15: Magnetic Systems

Q1. Why do computers require mass storage (secondary storage) devices alongside main memory?

- A) Main memory is volatile and limited in size
- B) Main memory is too slow
- C) Mass storage is cheaper per bit only
- D) CPUs cannot access main memory directly

Q2. On a magnetic disk, data is recorded along thin concentric circles called what?

- A) Sectors
- B) Tracks
- C) Cylinders
- D) Platters

Q3. Into what smaller segments is each track on a magnetic disk subdivided?

- A) Cells
- B) Sectors
- C) Bytes
- D) Clusters

Q4. Which physical mechanism positions over spinning disk surfaces to read or write data?

- A) Laser diode
- B) Read/write head on an access arm
- C) Flash chip
- D) Optical lens

Answer Key

A -- Mass storage is needed because main memory is volatile and limited in size.

B -- Magnetic disks organize storage into thin concentric circles called tracks.

B -- Each track on a disk platter is divided into smaller arc sections called sectors.

B -- Data is read or written by a read/write head attached to a moving access arm.

Module 16: Optical Systems

Q1. Which mass storage technology uses laser beams to read and store data on media like CDs and DVDs?

- A) Magnetic storage
- B) Optical storage
- C) Flash storage
- D) Cloud storage

Q2. How is the track structured on a Compact Disk (CD) compared to magnetic disks?

- A) As multiple parallel tracks
- B) As a single continuous spiral track
- C) As random sectors

D) As concentric cylinders

Q3. Which of the following is an example of an optical mass storage system?

- A) Dynamic RAM (DRAM)
- B) DVD
- C) Hard disk drive
- D) Flash drive

Q4. What does BD stand for in the context of optical disk storage media?

- A) Binary Disk
- B) Blu-ray Disk
- C) Byte Disk
- D) Backup Disk

Answer Key

B -- Optical storage systems apply light and laser technology to write and read data.

B -- A CD contains a single continuous track composed of sectors spiraling toward the outer edge.

B -- DVDs, CDs, and Blu-ray Disks are all examples of optical mass storage systems.

B -- BD stands for Blu-ray Disk in optical media.

Module 17: Flash Drives

Q1. What major drawback of magnetic and optical storage systems do flash drives eliminate?

- A) High manufacturing cost
- B) Moving mechanical parts and slow access
- C) Limited capacity
- D) Data volatility

Q2. What underlying technology is used in Flash Drives and Solid State Disks (SSDs)?

- A) Rotating platters
- B) Solid-state electronics with no moving parts
- C) Laser optics
- D) Magnetic tape

Q3. What does the abbreviation SSD stand for in modern storage systems?

- A) System Storage Device
- B) Solid State Disk
- C) Secure Digital Drive
- D) Serial Storage Device

Q4. Which Secure Digital (SD) card format offers extended capacity that can reach up to Terabytes?

- A) SDSC
- B) SDXC
- C) SDHC
- D) MiniSD

Answer Key

B -- Flash technology removes moving parts, avoiding physical wear and slow access delays found in mechanical drives.

B -- Flash drives use solid-state electronics containing no moving mechanical parts.

B -- SSD stands for Solid State Disk.

B -- SDXC (Secure Digital Extended Capacity) memory cards can scale storage capacity into Terabytes.

Module 18: Representing Text

Q1. How is text information represented and stored inside computer memory?

- A) As physical letters etched on chips
- B) As bit patterns mapped to characters
- C) As audio waveforms
- D) As pixel images only

Q2. What is the standard character encoding system that assigns bit patterns to text characters?

- A) ASCII
- B) MIDI
- C) JPEG
- D) MP3

Q3. What does the acronym ASCII stand for?

- A) Advanced System Code for Internal Integration
- B) American Standard Code for Information Interchange
- C) Automated Serial Code for Internet Interchange
- D) American Scientific Code for Information Indexing

Q4. In ASCII character encoding, what binary pattern represents the letter 'H'?

- A) 01001000
- B) 01100101
- C) 01001100
- D) 00110001

Answer Key

B -- Text is represented in memory by mapping characters to specific binary bit patterns.

A -- ASCII is a widely adopted system for encoding text characters into bit patterns.

B -- ASCII stands for American Standard Code for Information Interchange.

A -- As demonstrated in the handout's "Hello." example, the uppercase letter 'H' is represented by 01001000.

Module 19: Representing Numeric Values

Q1. Why is storing numeric values as text characters (such as Unicode) considered inefficient?

- A) Text encoding uses far more bits than pure binary notation
- B) Text cannot represent numbers
- C) Binary is slower than text
- D) Unicode is deprecated

Q2. How many distinct numerical values can be represented using a 16-bit binary pattern?

- A) 1,024
- B) 65,536
- C) 32,768
- D) 256

Q3. Which binary notation method is commonly used for representing whole signed numbers (integers)?

- A) Excess notation
- B) Two's complement
- C) Floating-point
- D) ASCII

Q4. Which notation system is designed specifically for storing fractional numbers?

- A) Two's complement
- B) Floating-point notation
- C) Excess-8
- D) BCD only

Answer Key

A -- Storing numbers as text requires 16 bits for a simple value like 12, whereas pure binary notation is far more compact.

B -- With 16 bits, $2^{16} = 65,536$ distinct values can be represented.

B -- Two's complement is the standard notation for storing whole numbers (integers).

B -- Floating-point notation is used for representing real numbers with fractional components.

Module 20: Representing Images

Q1. What is the term "pixel" short for in digital image storage?

- A) Picture Element
- B) Pixel Index Location
- C) Picture Excel
- D) Pixellated Element

Q2. What is formed when the collection of encoded pixel appearances is assembled together?

- A) Vector graphic
- B) Bitmap
- C) Audio track
- D) Text file

Q3. In a simple black-and-white image, how many bits are used to encode each individual pixel?

- A) 1 bit
- B) 8 bits
- C) 24 bits
- D) 4 bits

Q4. How many bits per pixel are used to represent various shades of gray in a grayscale image?

- A) 1 bit

- B) 4 bits
- C) 8 bits
- D) 16 bits

Answer Key

- A -- Pixel is short for "Picture Element".
- B -- Collecting encoded pixel appearances forms a bitmap.
- A -- Black-and-white images use 1 bit per pixel (0 for black, 1 for white).
- C -- Grayscale images use 8 bits per pixel to represent 256 shades of gray.

Module 21: Representing Sound

Q1. What system is mentioned as an alternative method for encoding sound data?

- A) MIDI
- B) ASCII
- C) JPEG
- D) GIF

Q2. In digital sound representation, what determines how frequently sound amplitude is measured?

- A) Sample Intervals
- B) Radix Point
- C) Mantissa
- D) Run-length

Q3. What property of a sound wave is sampled and converted into digital bits during sound encoding?

- A) Sound Amplitude
- B) Color Palette
- C) Pixel Density
- D) Sign Bit

Q4. How does sound data communication primarily take place in digital encoding?

- A) By transmitting sampled amplitude values or MIDI commands
- B) By converting sound into 8x8 pixel blocks
- C) By using two's complement addition
- D) By creating an HTML web page

Answer Key

- A -- MIDI is specified as an alternative method for encoding sound.
- A -- Sample intervals define the rate at which sound measurements are taken.
- A -- Digital sound encoding measures and records sound amplitude.
- A -- Sound data communication takes place by transmitting sampled amplitude sequences or MIDI control signals.

Module 22: Binary Notation

Q1. In positional binary notation, what is the value relationship of each position relative to the position on its right?

- A) Equal to the quantity on its right
- B) Twice the quantity associated with the position to its right
- C) Ten times the quantity on its right
- D) Half the quantity on its right

Q2. Which algorithm step is repeatedly performed to convert a positive decimal number into its binary representation?

- A) Repeated division by 2 and recording the remainders
- B) Multiplying repeatedly by 10
- C) Subtracting 8 from the exponent
- D) Inverting bits using XOR logic

Q3. What binary pattern represents the decimal value 32 using an 8-bit position system?

- A) 00000001
- B) 00100000
- C) 11111111
- D) 00001000

Q4. What is the maximum decimal value represented when all 8 bit positions in a byte are set to 1 (11111111)?

- A) 128
- B) 255
- C) 256
- D) 512

Answer Key

B -- Each binary position represents twice the quantity of the position to its right.

A -- Converting a positive decimal number to binary uses repeated division by 2 and collects remainders.

B -- The 8-bit pattern 00100000 places a 1 in the (2^5) (32) position.

B -- Setting all 8 bits to 1 (11111111) yields $128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255$.

Module 23: Binary Addition

Q1. When adding two single bits in binary, what is the result of $1 + 1$?

- A) 0
- B) 1
- C) 10
- D) 11

Q2. How many possible input combinations exist when performing addition on two binary bits?

- A) 2
- B) 4
- C) 8
- D) 16

Q3. When adding binary columns from right to left, what action is taken when a column sum results in 10?

- A) Place 0 in that column and carry 1 to the next column on the left
- B) Place 1 in that column and discard the 0
- C) Stop the addition algorithm
- D) Convert the result to hexadecimal E

Q4. What is the result of adding binary 0 + 1?

- A) 0
- B) 1
- C) 10
- D) 11

Answer Key

- C -- In binary addition, $1 + 1$ produces 10 (0 sum with a carry of 1).
- B -- There are 4 possible cases when adding two bits: $0+0$, $1+0$, $0+1$, and $1+1$.
- A -- When a column yields 10, 0 is placed in the column and 1 is carried left.
- B -- Adding $0 + 1$ equals 1.

Module 24: Fraction in Binary

Q1. What symbol is used in binary fraction representation to separate the whole number from the fractional part?

- A) Decimal point
- B) Radix point
- C) Binary comma
- D) Exponent line

Q2. In a binary fraction, what quantity is represented by the first bit position directly to the right of the radix point?

- A) $1/2$
- B) $1/4$
- C) $1/8$
- D) $1/16$

Q3. When adding two binary fractions, what key alignment step must be performed first?

- A) Align the radix points of both numbers
- B) Convert both numbers into excess notation
- C) Invert all fractional bits
- D) Discard the fractional parts

Q4. What is the decimal equivalent of the binary sum 111.001 (obtained by adding 10.011 and 100.11)?

- A) 7.125
- B) 5.625
- C) 3.375
- D) 12.25

Answer Key

- B -- The separator between whole numbers and fractional parts in binary is called the radix point.

A -- The first bit position to the right of the radix point represents (2^{-1}) , which is $1/2$.

A -- Adding binary fractions requires aligning the radix points before addition.

A -- Binary 111.001 converts to $4 + 2 + 1 + 1/8 = 7.125$ (or $7 \frac{1}{8}$).

Module 25: 2's Complement Notation to Store Numbers

Q1. What is the most popular system used within modern computers for storing signed integers?

- A) Floating-point notation
- B) Two's complement notation
- C) Excess-4 notation
- D) Dictionary encoding

Q2. In two's complement notation, what does a leftmost bit (sign bit) of 1 signify?

- A) The stored value is nonnegative
- B) The stored value is negative
- C) The number is a fraction
- D) An overflow has occurred

Q3. What shortcut rule converts a positive two's complement binary number into its negative representation?

- A) Copy bits from right to left through the first 1, then invert all remaining bits to the left
- B) Invert all bits and add 1 at the leftmost side
- C) Move the radix point 3 places left
- D) Replace all 0s with 1s without copying

Q4. What condition occurs when an arithmetic operation produces a result that exceeds the maximum representable value of a fixed-length bit pattern?

- A) Truncation error
- B) Overflow
- C) Underflow
- D) Normalization

Answer Key

B -- Two's complement is the most popular notation for storing integers in modern computers.

B -- The leftmost bit acts as the sign bit, where 1 indicates a negative value.

A -- The shortcut involves copying bits from the right through the first 1, then complementing all remaining bits to the left.

B -- Overflow occurs when a calculated value exceeds the storage limit of the fixed bit pattern.

Module 26: Excess Notation

Q1. In Excess notation, which bit pattern is designated to represent the value zero?

- A) The pattern consisting of all 0s
- B) The first bit pattern having a 1 in its most significant bit
- C) The pattern consisting of all 1s
- D) The pattern ending with 11

Q2. In an Excess-4 notation system using 3-bit patterns, what decimal value does the pattern 100 represent?

- A) 4
- B) 0
- C) -4
- D) 8

Q3. In Excess-8 notation, how are positive numbers represented relative to zero?

- A) By bit patterns that follow the zero pattern (values greater than 1000)
- B) By bit patterns preceding 0000
- C) By placing a 0 in the sign bit position
- D) By setting all bits to 1

Q4. Which Excess notation uses the bit pattern 10000 to represent the number zero?

- A) Excess 4
- B) Excess 8
- C) Excess 16
- D) Excess 32

Answer Key

B -- Zero is represented by the first bit pattern starting with a 1 in its most significant bit.

B -- In Excess-4 notation, 100 represents zero.

A -- Positive values are represented by bit patterns that follow the zero pattern.

C -- Excess-16 notation uses the 5-bit pattern 10000 to represent zero.

Module 27: Floating Point Notation

Q1. In an 8-bit floating-point system, into which three fields is the byte divided from left to right?

- A) Sign bit (1 bit), Exponent field (3 bits), Mantissa field (4 bits)
- B) Mantissa (4 bits), Exponent (3 bits), Sign bit (1 bit)
- C) Radix field (2 bits), Sign bit (2 bits), Mantissa (4 bits)
- D) Header (2 bits), Payload (5 bits), Parity (1 bit)

Q2. How is the 3-bit exponent field interpreted in standard 8-bit floating-point notation?

- A) As an integer stored using 3-bit Excess notation
- B) As a two's complement integer
- C) As an ASCII character code
- D) As an unencoded binary fraction

Q3. What rule defines a floating-point representation as being in "normalized form"?

- A) The mantissa is copied starting with the leftmost 1 in the binary representation
- B) The exponent is set to zero
- C) All 8 bits are set to 1
- D) The sign bit is always 1

Q4. In floating-point representation, how is the special value zero stored?

- A) A bit pattern of all 0s
- B) A bit pattern of all 1s

- C) Mantissa of 1111 and exponent of 000
- D) Sign bit of 1 with zero exponent

Answer Key

- A -- An 8-bit floating-point byte is divided into 1 sign bit, a 3-bit exponent field, and a 4-bit mantissa field.
- A -- The exponent field is interpreted as an integer stored using 3-bit excess notation.
- A -- Normalization requires copying the mantissa starting with the leftmost 1 of the binary value.
- A -- Zero is a special case represented by a bit pattern of all 0s.

Module 28: Truncation Errors in Floating Point Notation

Q1. What is a truncation error (or round-off error) in floating-point storage?

- A) The loss of precision that occurs when a value exceeds the capacity of the mantissa field
- B) A hardware failure in the CPU arithmetic unit
- C) An error caused by invalid ASCII character encoding
- D) An overflow in two's complement integer addition

Q2. Why does the decimal value 1/10 (one dime) cause issues in binary floating-point representation?

- A) It has a nonterminating expansion in binary notation
- B) It cannot be converted into binary digits
- C) It requires an Excess-64 notation system
- D) It produces a negative sign bit

Q3. How can a programmer avoid truncation errors when handling monetary calculations like dollars and cents?

- A) Perform calculations in units of pennies as integers
- B) Use 4-bit floating-point notation
- C) Multiply all values by 3 before saving
- D) Store amounts as ASCII text strings

Q4. Why does adding small floating-point quantities together before adding them to a large quantity improve accuracy?

- A) It prevents small fractional values from being truncated when aligned with a large exponent
- B) It automatically converts numbers to two's complement
- C) It doubles the size of the mantissa field
- D) It clears the sign bit

Answer Key

- A -- Truncation error occurs when part of a value is lost because the mantissa field is not large enough.
- A -- The value 1/10 is a nonterminating repeating fraction in binary notation.
- A -- Working in pennies allows values to be processed as exact integers using two's complement.
- A -- Summing small numbers first accumulates them into a significant magnitude before combining with a large value.

Module 29: Data Compression: Generic Techniques

Q1. What is the defining characteristic of a lossless data compression scheme?

- A) No information is lost during the compression process
- B) Some data is discarded to achieve maximum compression
- C) It can only be used on video files
- D) It relies on 8-bit floating-point conversion

Q2. Which compression technique replaces long sequences of identical data elements with a code indicating the element and its repetition count?

- A) Run-length encoding
- B) Frequency-dependent encoding
- C) Relative encoding
- D) Dictionary encoding

Q3. What type of compression code assigns shorter bit patterns to frequently occurring data items and longer patterns to rare items?

- A) Frequency-dependent encoding (such as Huffman code)
- B) Fixed-length ASCII encoding
- C) Excess-8 notation
- D) Two's complement encoding

Q4. Which encoding scheme records only the differences between consecutive data units rather than entire units?

- A) Relative (or differential) encoding
- B) Run-length encoding
- C) Dictionary encoding
- D) Floating-point encoding

Answer Key

A -- Lossless compression schemes retain all original information without data loss.

A -- Run-length encoding replaces repeated identical data elements with a code representing the element and its count.

A -- Frequency-dependent encoding (Huffman coding) uses shorter bit patterns for more frequent items.

A -- Relative/differential encoding records differences between consecutive data units.

Module 30: Data Compression: Compressing Images

Q1. How does the GIF image format reduce file size using a dictionary system?

- A) By maintaining a palette of 256 colors where each pixel is represented by an 8-bit palette index
- B) By converting all image pixels to two's complement integers
- C) By deleting every second row of pixels
- D) By saving images as ASCII text files

Q2. Which mathematical technique is applied to 8x8 pixel blocks in JPEG image compression?

- A) Discrete Cosine Transform (DCT)
- B) Two's complement addition
- C) Run-length decoding
- D) Huffman tree inversion

Q3. Why is baseline JPEG compression considered a lossy compression method?

- A) High-frequency details and subtle color variations imperceptible to the human eye are discarded

- B) It reduces image resolution to 1x1 pixel
- C) It converts images into black-and-white text
- D) It loses all color information permanently

Q4. What does the abbreviation TIFF stand for in image file formats?

- A) Tagged Image File Format
- B) Transformed Image Frequency Factor
- C) Text and Image Transfer Format
- D) Table Indexed Fast Format

Answer Key

A -- GIF uses a 256-color palette dictionary where 1 byte indexes each pixel's color.

A -- JPEG applies the Discrete Cosine Transform to 8x8 pixel blocks.

A -- JPEG achieves high compression ratios by discarding visual details that the human eye cannot easily distinguish.

A -- TIFF stands for Tagged Image File Format.

Module 31: Data Compression: Compressing Audio and Videos

Q1. MP3 recordings generally require transfer rates of no more than what bandwidth compared to uncompressed audio?

- A) 64 Kbps
- B) 40 Mbps
- C) 1024 KB
- D) 128 Gbps

Q2. Uncompressed high-fidelity digital audio typically requires transfer rates around which value?

- A) 64 Kbps
- B) 40 Mbps
- C) 100 Kbps
- D) 512 Mbps

Q3. Video compression standards like MPEG reduce file sizes by eliminating which type of redundancy between successive frames?

- A) Spatial and temporal redundancy
- B) Hexadecimal conversion errors
- C) Program counter offsets
- D) Parity bit discrepancies

Q4. Which audio compression format is widely used for digital audio recordings due to its efficient lossy compression?

- A) MP3
- B) ASCII
- C) ASCII-8
- D) BMP

Answer Key

A -- MP3 recordings generally require transfer rates of no more than 64 Kbps.

B -- Uncompressed high-fidelity digital audio typically requires transfer rates of around 40 Mbps.

A -- Video compression (such as MPEG) eliminates both spatial and temporal redundancies across video frames.

A -- MP3 is the standard lossy compression format for audio streams described in the handout.

Module 32: Data Manipulation: CPU Basic

Q1. Which three main components make up the Central Processing Unit (CPU)?

- A) Arithmetic/Logic Unit, Control Unit, and Registers
- B) Main Memory, Flash Drive, and Bus
- C) Program Counter, Instruction Register, and Hard Disk
- D) Abacus, Vacuum Tubes, and Transistors

Q2. What system component connects the CPU to main memory for data transfer?

- A) Bus
- B) Track
- C) Sector
- D) Flip-flop

Q3. Which part of the CPU contains the circuitry that performs data operations such as addition and comparison?

- A) Control Unit
- B) Arithmetic/Logic Unit (ALU)
- C) Mass Storage
- D) Main Memory

Q4. What is the role of registers within the CPU?

- A) They serve as temporary high-speed storage cells inside the CPU for holding data and instructions
- B) They store permanent magnetic tracks on rotating platters
- C) They replace the operating system kernel
- D) They execute HTTP requests over the network

Answer Key

A -- The CPU consists of the Arithmetic/Logic Unit, Control Unit, and Registers.

A -- A bus serves as the electronic communication link connecting the CPU to main memory.

B -- The Arithmetic/Logic Unit contains the circuitry that manipulates data through arithmetic and logical operations.

A -- Registers act as internal CPU storage locations for quickly accessing data and intermediate results.

Module 33: Data Manipulation: Stored Program

Q1. Early electronic computers were rewired for different tasks using what mechanism?

- A) Jumper wires plugged into pegboards
- B) Optical laser discs
- C) Microphones
- D) HTML anchor tags

Q2. Who is historically credited with the breakthrough realization of the stored-program concept?

- A) John von Neumann
- B) George Boole
- C) Herman Hollerith
- D) Charles Babbage

Q3. What is the fundamental idea behind the stored-program concept?

- A) Storing program instructions as bit patterns in main memory along with data
- B) Printing program instructions physically on paper tape
- C) Storing code exclusively on external magnetic platters
- D) Hardwiring every operation permanently into CPU hardware

Q4. How does the stored-program concept enhance a computer's operation?

- A) It provides flexibility by allowing computer programs to be changed without rewiring hardware
- B) It increases the physical size of vacuum tubes
- C) It eliminates the need for main memory cells
- D) It forces all calculations to be processed in decimal notation

Answer Key

- A -- Early electronic computers achieved task flexibility by plugging jumper wires into pegboards.
- A -- The realization of the stored-program concept is historically credited to John von Neumann.
- A -- The stored-program concept places encoded program instructions into main memory alongside data.
- A -- Storing programs in memory allows computers to switch execution tasks flexibly without hardware rewiring.

Module 34: Data Manipulation: CPU Architecture Philosophies

Q1. The set of instructions encoded as bit patterns that a CPU is designed to recognize is called what?

- A) Machine language
- B) Assembly language
- C) High-level language
- D) Pseudocode

Q2. What does RISC stand for in CPU architecture philosophy?

- A) Reduced Instruction Set Computer
- B) Random Instruction Storage Unit
- C) Relational Instruction System Center
- D) Rapid Integration Serial Circuit

Q3. How does a CISC (Complex Instruction Set Computer) architecture differ from RISC?

- A) CISC includes a large, complex set of instructions, whereas RISC uses a small set of simple instructions
- B) CISC cannot execute binary addition
- C) CISC uses no registers inside the CPU
- D) RISC requires optical storage media to function

Q4. An individual instruction expressed in machine language is commonly referred to as what?

- A) A machine level instruction
- B) A source file

- C) A macro variable
- D) An HTML element

Answer Key

- A -- The collection of bit-pattern instructions recognized by a CPU is called machine language.
- A -- RISC stands for Reduced Instruction Set Computer.
- A -- CISC architectures provide expansive, complex instruction sets, whereas RISC designs streamline processing with fewer, simpler instructions.
- A -- An instruction written in machine language is called a machine level instruction or machine instruction.

Module 35: Data Manipulation: Machine Instruction Categories

Q1. Into which three categories are machine instructions grouped regardless of CPU architecture?

- A) Data Transfer Group, Arithmetic/Logic Group, and Control Group
- B) Input Group, Processing Group, and Output Group
- C) Read Group, Write Group, and Delete Group
- D) Integer Group, Floating-Point Group, and Character Group

Q2. Which instruction group includes commands that request the movement of data between memory and registers?

- A) Data Transfer Group
- B) Control Group
- C) Arithmetic/Logic Group
- D) Pipelining Group

Q3. What type of machine instruction directs the execution sequence of a program rather than manipulating data?

- A) Control Group instruction (e.g., JUMP)
- B) Data Transfer Group instruction
- C) Bitwise AND instruction
- D) Rotation instruction

Q4. Operations like ADD, OR, AND, and XOR belong to which machine instruction category?

- A) Arithmetic/Logic Group
- B) Data Transfer Group
- C) Control Group
- D) Direct Memory Access Group

Answer Key

- A -- Machine instructions fall into three categories: Data Transfer, Arithmetic/Logic, and Control.
- A -- The Data Transfer group consists of instructions requesting the movement of data from one location to another.
- A -- Control instructions (such as JUMP or HALT) direct the execution sequence of the program.
- A -- Operations performing math or bitwise logical evaluation are classified under the Arithmetic/Logic group.

Module 36: Data Manipulation: Program Execution

Q1. What are the three basic steps of the CPU Machine Cycle executed in continuous order?

- A) Fetch, Decode, and Execute
- B) Read, Write, and Compress
- C) Initialize, Test, and Modify
- D) Compile, Link, and Run

Q2. Which special-purpose CPU register holds the address of the next instruction to be executed?

- A) Program Counter (PC)
- B) Instruction Register (IR)
- C) Accumulator
- D) Stack Pointer

Q3. What is the function of the Instruction Register (IR)?

- A) To hold the machine instruction currently being executed
- B) To store the address of the next instruction in main memory
- C) To keep track of the total system clock speed
- D) To convert ASCII characters into binary

Q4. Unless a JUMP instruction is encountered, in what order are instructions fetched from main memory?

- A) In sequential order as they are stored in memory
- B) In random numerical order
- C) In reverse order from bottom to top
- D) According to file size

Answer Key

- A -- The machine cycle consists of the three-step loop: Fetch, Decode, and Execute.
- A -- The Program Counter contains the memory address of the next instruction to be executed.
- A -- The Instruction Register holds the bit pattern of the instruction currently being executed.
- A -- Instructions are fetched sequentially from memory unless altered by a JUMP control instruction.

Module 37: Data Manipulation: Program Execution Example

Q1. In the handout's machine instruction example, what does the encoded instruction 156C mean?

- A) Load register 5 with the bit pattern found in memory cell 6C
- B) Store register 5 into memory address 6C
- C) Add contents of register 5 and 6
- D) Halt execution

Q2. Which instruction code is used in the execution example to halt the CPU execution?

- A) C000
- B) 5056
- C) 306E
- D) 156C

Q3. What operation is represented by the instruction 5056 in the provided example?

- A) Add the contents of registers 5 and 6 as two's complement values and leave the result in register 0

- B) Move the bit pattern from address 50 to address 56
- C) Jump to memory location 5056
- D) Rotate register 5 by 6 bits

Q4. In the machine instruction 306E, what action is requested by the CPU?

- A) Store the contents of register 0 into the memory cell at address 6E
- B) Load memory cell 30 into register 6E
- C) Clear all bits in register 3
- D) Compare register 3 and register 6

Answer Key

- A -- Instruction 156C loads register 5 with the data stored at memory address 6C.
- A -- The instruction C000 translates to Halt, stopping CPU program execution.
- A -- Instruction 5056 adds the two's complement bit patterns in registers 5 and 6, storing the sum in register 0.
- A -- Instruction 306E stores the result in register 0 into memory cell address 6E.

Module 38: Data Manipulation: Logic Operators

Q1. What term describes operations that combine two bit strings to produce a single output string by applying Boolean operations to corresponding bits?

- A) Bitwise operations
- B) Floating-point additions
- C) Pipelining operations
- D) Direct memory transfers

Q2. What is the process of using a bitwise AND operation with a bit pattern to clear specific bits to zero while leaving others unchanged called?

- A) Masking
- B) Truncation
- C) Normalization
- D) Decoding

Q3. What is the result of performing a bitwise XOR on 10011010 and 11001001?

- A) 01010011
- B) 10001000
- C) 11011011
- D) 11111111

Q4. Which bitwise operation can be used to complement or invert all the bits in a register?

- A) NOT (or XORing with a pattern of all 1s)
- B) AND
- C) Shift Right
- D) Parallel Transfer

Answer Key

- A -- Bitwise operations apply Boolean logic across matching positions of two bit strings.
- A -- Masking uses a bitwise AND operation to filter or clear unwanted bit positions.
- A -- XOR yields 1 where bits differ and 0 where bits match, resulting in 01010011.

A -- The NOT operation (or XORing with all 1s) complements every bit in the pattern.

Module 39: Data Manipulation: Rotation and Shift

Q1. What class of operations provides a means for moving bits within a register to solve alignment problems?

- A) Rotation and Shift operations
- B) Commit/Rollback operations
- C) Data Mining operations
- D) Parsing operations

Q2. How does a circular shift (rotation) differ from a logical shift?

- A) Bits shifted off one end of the register are re-inserted at the opposite end
- B) Bits shifted out are deleted while zeros fill from both sides
- C) It can only shift bits to the right
- D) It doubles the binary value regardless of sign bit

Q3. In a non-circular right logical shift on an 8-bit register, what value fills the vacant bit position at the left end?

- A) 0
- B) 1
- C) The sign bit copied
- D) The bit that was dropped from the right

Q4. Shift and rotation operations are primarily classified according to which parameters?

- A) Direction of motion (right or left) and whether the process is circular
- B) Number of CPU cycles required
- C) Whether the data is ASCII or Unicode
- D) Main memory address size

Answer Key

A -- Rotation and shift operations allow bits to be moved within a register for alignment tasks.

A -- Circular shifts rotate falling bits back into the opposite end of the register.

A -- Non-circular logical shifts fill the newly opened bit positions with 0s.

A -- Shifts and rotations are classified by direction (right/left) and circularity.

Module 40: Data Manipulation: Arithmetic Operators

Q1. How is subtraction typically simulated in CPU arithmetic logic using two's complement notation?

- A) By addition and negation (e.g., $7 - 5$ is computed as $7 + (-5)$)
- B) By circular left shift
- C) By masking with AND logic
- D) By dividing the minuend by 2

Q2. Binary multiplication can be implemented in computer circuitry through a combination of which repeated operations?

- A) Addition and bit shifting
- B) Subtraction and masking

- C) XORing and truncating
- D) Fetching and halting

Q3. What condition occurs during arithmetic operations if a result exceeds the maximum value the destination register can store?

- A) Overflow
- B) Truncation
- C) Underflow
- D) Pipelining stall

Q4. In floating-point arithmetic, why must values be normalized and their exponents aligned before performing addition or subtraction?

- A) To ensure corresponding fractional bit positions align correctly before adding or subtracting
- B) To convert numbers into ASCII text
- C) To prevent the program counter from resetting
- D) To clear the instruction register

Answer Key

- A -- Subtraction is simulated in two's complement by negating the subtrahend and adding.
- A -- Binary multiplication is performed by combining shift operations with repeated addition.
- A -- Overflow occurs when a calculated value is too large to fit in the designated register.
- A -- Exponents must be equalized so fractional radix points line up before addition or subtraction.

Module 41: Data Manipulation: Role of Controller

Q1. What intermediary apparatus handles communication between a computer and other peripheral devices?

- A) Control Unit
- B) Controller
- C) Accumulator
- D) Program Counter

Q2. Standards such as Universal Serial Bus (USB) and FireWire allow a single controller to do what?

- A) Handle a variety of compatible peripheral devices
- B) Increase CPU clock speed
- C) Store operating system kernels permanently
- D) Replace main memory flip-flops

Q3. How does the CPU communicate with controllers attached to the system bus?

- A) By sending optical signals through laser diodes
- B) Using instructions similar to LOAD and STORE
- C) By executing JUMP instructions only
- D) By rewriting the boot loader

Q4. Where may a controller be located within a personal computer system?

- A) Mounted on the motherboard or plugged into an expansion slot
- B) Inside the arithmetic logic unit only
- C) Exclusively inside the mouse casing

D) On external satellite towers

Answer Key

B -- A controller serves as an intermediary apparatus that translates data between a computer and peripheral devices.

A -- USB and FireWire standards enable a single controller to interface with a wide range of peripheral devices.

B -- The CPU communicates with controllers over the bus using instructions similar to LOAD and STORE.

A -- Controllers can be permanently mounted on the motherboard or take the form of expansion circuit boards plugged into slots.

Module 42: Data Manipulation: Direct Memory Access and Handshaking

Q1. What capability allows a controller to access main memory directly without burdening the CPU?

- A) Direct Memory Access (DMA)
- B) Dynamic Random Access Memory (DRAM)
- C) Vector Processing
- D) Pipelining

Q2. What is a primary benefit of using Direct Memory Access (DMA) during data transfer?

- A) CPU computing resources are not wasted during relatively slow data transfers
- B) It eliminates the need for main memory cells
- C) It stops all peripheral operations completely
- D) It increases the physical size of CPU registers

Q3. What impediment arises on the central bus when the CPU and multiple controllers compete for bus access?

- A) Truncation error
- B) von Neumann bottleneck
- C) Overflow condition
- D) Execution loop

Q4. What causes the von Neumann bottleneck during DMA and CPU activity?

- A) Competition for access to the central bus over which instructions and data are fetched
- B) Overheating of vacuum tubes
- C) Inversion of sign bits in floating-point math
- D) Lack of ASCII character codes

Answer Key

A -- Direct Memory Access (DMA) allows a controller to read or write main memory without requiring CPU intervention.

A -- DMA prevents CPU computing resources from being wasted while slow data transfers take place between disk and RAM.

B -- Competition for bus access between the CPU and controllers leads to the von Neumann bottleneck.

A -- The von Neumann bottleneck results from fetching instructions and data over a shared central bus where devices compete for access.

Module 43: Data Manipulation: Communication Media and Communication Rates

Q1. Which type of communication transfers several signals simultaneously over separate lines?

- A) Serial communication
- B) Parallel communication
- C) Single-bit communication
- D) Asynchronous polling

Q2. How is data transferred in serial communication paths like USB, FireWire, and Ethernet?

- A) Transmitting data bits one after another over a simpler path
- B) Sending 32 bits at the exact same nanosecond over 32 wires
- C) Using mechanical gear teeth
- D) By converting all text into hexadecimal arrays first

Q3. What unit is used to measure the rate at which bits are transferred between computing components?

- A) Hertz (Hz)
- B) Bits per second (bps)
- C) Bytes per sector
- D) Nanoseconds per instruction

Q4. What transfer rate in Kilo-bits per second (Kbps) is equivalent to transferring 1 KB of data per second?

- A) 1 Kbps
- B) 8 Kbps
- C) 64 Kbps
- D) 1024 Kbps

Answer Key

B -- Parallel communication transfers several signals at the same time, each on a separate transmission line.

A -- Serial communication streams data bits one after another over a simple data path.

B -- Data transmission speed between computing components is measured in bits per second (bps).

B -- Since 1 Byte contains 8 bits, a transfer rate of 8 Kbps equals 1 KB per second.

Module 44: Data Manipulation: Pipelining

Q1. What term refers to the total amount of work a computer can accomplish in a given amount of time?

- A) Throughput
- B) Latency
- C) Seek time
- D) Frequency

Q2. What technique improves machine throughput by overlapping the fetch, decode, and execute steps of the machine cycle?

- A) Pipelining

- B) Masking
- C) Normalization
- D) Spooling

Q3. What instruction type reduces the performance gain obtained by pipelining pre-fetched instructions?

- A) LOAD instruction
- B) JUMP instruction
- C) STORE instruction
- D) ADD instruction

Q4. How does pipelining increase total throughput without increasing individual instruction execution speed?

- A) By allowing multiple instructions to be at different processing stages in "the pipe" simultaneously
- B) By shortening the physical length of CPU copper wires
- C) By storing instructions in optical discs
- D) By changing 2's complement numbers to floating point

Answer Key

A -- Throughput is defined as the total amount of work a machine can accomplish in a specified amount of time.

A -- Pipelining overlaps the stages of the machine cycle to process multiple instructions concurrently.

B -- JUMP instructions invalidate pre-fetched instructions in the pipeline, losing the prefetching advantage.

A -- Pipelining increases throughput by having more than one instruction in "the pipe" at various execution stages at any given time.

Module 45: Operating Systems: History

Q1. In early 1940s and 1950s computing, what was an isolated execution of a single program called?

- A) A thread
- B) A job
- C) A process switch
- D) A semaphore

Q2. What system executes collected jobs in sequence without requiring further user interaction during execution?

- A) Interactive processing
- B) Batch processing
- C) Real-time processing
- D) Distributed processing

Q3. Which language was encoded with jobs in early batch systems to convey machine setup instructions to the computer operator?

- A) Job Control Language (JCL)
- B) Hypertext Markup Language (HTML)
- C) Assembly Language
- D) Structured Query Language (SQL)

Q4. What operating system feature allowed programs to carry on an active dialogue with users via remote terminals?

- A) Batch queueing
- B) Interactive processing
- C) Paging
- D) Direct Memory Access

Answer Key

B -- Early computer program execution was treated as an isolated activity known as a job.

B -- Batch processing collects jobs into a single batch and executes them sequentially without ongoing user interaction.

A -- Job Control Language (JCL) encoded setup instructions that were printed for computer operators.

B -- Interactive processing enabled programs to communicate directly and dynamically with users at terminals.

Module 46: Operating Systems: Basic Concepts (I)

Q1. Which processing system performs tasks in strict accordance with deadlines set by its external environment (e.g., radar or missile systems)?

- A) Batch processing
- B) Real-time processing
- C) Spooling
- D) Offline processing

Q2. What operating system design allowed early expensive computers in the 1960s and 1970s to serve multiple remote users simultaneously?

- A) Time-sharing
- B) Single-user execution
- C) Bootstrapping
- D) Non-privileged mode

Q3. How is time-sharing implemented by executing each job for a short time interval before switching?

- A) Multiprogramming
- B) Hardware rewiring
- C) Static linking
- D) Truncation

Q4. What term describes a single user executing several tasks or applications simultaneously on a computer?

- A) Multitasking
- B) Batch processing
- C) Parsing
- D) Compiling

Answer Key

B -- Real-time processing requires the computer to perform tasks within deadlines dictated by its external real-world environment.

A -- Time-sharing operating systems were created to service multiple users at remote terminals concurrently.

A -- Multiprogramming implements time-sharing by allocating small time intervals to execute portions of different jobs.

A -- Multitasking refers to a single user running multiple tasks simultaneously.

Module 47: Operating Systems: Basic Concepts (II)

Q1. As computer operations became automated and unattended, what job role replaced the traditional hands-on computer operator?

- A) System Administrator
- B) Keypunch Operator
- C) Web Designer
- D) Software Tester

Q2. In multiprocessor operating systems, what is the term for dynamically allocating tasks across processors to use all CPU cores efficiently?

- A) Load balancing
- B) Scaling
- C) Paging
- D) Masking

Q3. Computer systems built into dedicated devices such as medical equipment, appliances, and automobiles are called what?

- A) Embedded systems
- B) Mainframes
- C) Supercomputers
- D) Desktop publishing systems

Q4. What is a typical constraint or requirement for an embedded operating system?

- A) Conserving battery power and meeting demanding real-time deadlines
- B) Requiring a human operator to mount magnetic tapes manually
- C) Storing all files as uncompressed WAV audio
- D) Running MS-DOS cmd.exe shells exclusively

Answer Key

A -- The hands-on computer operator role evolved into the system administrator who manages accounts, equipment, and storage policies.

A -- Load balancing dynamically allocates tasks among multiple processors to ensure efficient CPU utilization.

A -- Computer systems embedded inside dedicated devices (like cars, appliances, or phones) are called embedded systems.

A -- Embedded operating systems are designed to conserve power, run autonomously, and meet real-time constraints.

Module 48: Operating Systems: Software Classification

Q1. Software is broadly divided into which two main categories?

- A) Application software and System software
- B) Utility software and Firmware
- C) High-level software and Low-level software
- D) Public domain software and Shareware

Q2. Spreadsheets, database systems, desktop publishing, and games are examples of which software category?

- A) System software
- B) Application software
- C) Operating system kernels
- D) Device drivers

Q3. What type of system software extends or customizes operating system capabilities (e.g., file compression, disk formatting, or media players)?

- A) Utility software
- B) Application software
- C) User interface shells
- D) Boot loaders

Q4. How does system software differ from application software?

- A) System software performs tasks common to computer systems in general, providing infrastructure for application software
- B) System software is used only for writing business accounting spreadsheets
- C) System software cannot communicate with main memory
- D) Application software is required to boot the machine

Answer Key

A -- All machine software is broadly classified into application software and system software.

B -- Applications perform specific user-oriented tasks, such as spreadsheets, databases, and games.

A -- Utility software consists of system programs that extend or customize OS capabilities (like disk formatting or compression).

A -- System software provides common infrastructure for the general operation of the computer upon which applications rely.

Module 49: Operating Systems: Components (I)

Q1. What portion of an operating system handles direct communication with human users?

- A) User interface
- B) Memory manager
- C) Scheduler
- D) Dispatcher

Q2. What were older textual user interfaces that communicated via typed keyboard commands and text screens called?

- A) Shells
- B) Drivers
- C) Kernels
- D) Flip-flops

Q3. Which component within a Graphical User Interface (GUI) allocates screen space into windows and tracks associated applications?

- A) Window manager
- B) File manager
- C) Boot loader

D) Device driver

Q4. Which of the following is an example of a GUI window manager available for Linux systems?

- A) KDE or Gnome
- B) C shell or Bourne shell
- C) MS-DOS cmd.exe
- D) ASCII code

Answer Key

A -- The user interface component of an OS handles communication between the user and the system.

A -- Older text-based user interfaces are known as shells.

A -- The window manager allocates screen windows to applications and manages GUI visual styles and mouse click events.

A -- Popular Linux GUI window managers include KDE and Gnome.

Module 50: Operating Systems: Components (II)

Q1. What is the internal core part of an operating system containing basic required software components called?

- A) Kernel
- B) Shell
- C) Utility
- D) Application

Q2. Which kernel component coordinates mass storage facilities, maintains file location records, and enforces access permissions?

- A) File manager
- B) Memory manager
- C) Device driver
- D) Dispatcher

Q3. What software units in the kernel translate generic I/O requests into device-specific instructions for hardware controllers?

- A) Device drivers
- B) Shells
- C) Boot loaders
- D) Window managers

Q4. What technique creates virtual memory by shuffling uniform-sized blocks of data (pages) between main memory and mass storage?

- A) Paging
- B) Masking
- C) Pipelining
- D) Vectorizing

Answer Key

A -- The internal core of an operating system is called the kernel.

- A -- The file manager controls mass storage, maintains file directories, and manages file access permissions.
- A -- Device drivers translate generic operating system requests into specific commands for peripheral controllers.
- A -- Paging rotates memory pages between RAM and disk mass storage to create virtual memory.

Module 51: Operating Systems: Process of Booting

Q1. What is the procedure that transfers the operating system from mass storage into main memory when the computer is turned on called?

- A) Paging
- B) Bootstrapping (Bootting)
- C) Spooling
- D) Multiprogramming

Q2. Why is a boot loader program stored in nonvolatile Read-Only Memory (ROM) rather than standard RAM?

- A) Standard main memory (RAM) is volatile and loses its contents when turned off
- B) ROM is faster than CPU general-purpose registers
- C) RAM cannot execute JUMP instructions
- D) Mass storage cannot hold binary machine instructions

Q3. In modern PCs, which technology is commonly used to construct ROM so that firmware updates can be applied?

- A) Dynamic RAM
- B) Flash memory technology
- C) Magnetic disk tracks
- D) Optical laser pits

Q4. What is the final action taken by the boot loader once the operating system is placed into main memory?

- A) It executes a JUMP instruction to transfer control to the operating system
- B) It turns off the central processing unit
- C) It formats the secondary hard drive
- D) It clears all nonvolatile ROM cells

Answer Key

- B -- Bootstrapping (or booting) is the startup procedure that transfers the operating system from secondary storage into volatile main memory.
- A -- Main memory is volatile and erased when turned off, so the initial boot loader must reside in nonvolatile ROM.
- B -- Modern ROM is constructed using flash memory technology, allowing firmware updates to be made when necessary.
- A -- After loading the OS into RAM, the boot loader directs the CPU to jump to the OS code to begin execution.

Module 52: Operating Systems: Process and its Administration

Q1. In modern operating systems, what is the fundamental distinction between a program and a process?

- A) A program is a static set of instructions, whereas a process is the dynamic activity of executing a program
- B) A program runs in RAM, whereas a process resides only on optical media
- C) A program is dynamic, whereas a process is static
- D) A program is written in assembly, whereas a process is written in HTML

Q2. What term refers to the current status of an executing program at any particular snapshot in time?

- A) Process state
- B) Boot loader
- C) Frame rate
- D) File schema

Q3. Which of the following components forms part of a process's current state?

- A) The value of the Program Counter, CPU registers, and associated memory cells
- B) The physical serial port baud rate
- C) The manufacturer ID of the monitor
- D) The URL path of the web server

Q4. To illustrate the concept of a program versus a process, the handout compares a program to what static item?

- A) A music sheet
- B) A magnetic read/write head
- C) An Ethernet router
- D) A flip-flop circuit

Answer Key

A -- A program is a static set of instructions, while a process is the dynamic activity of executing those instructions.

A -- The process state represents the snapshot of a process's execution status at a given moment.

A -- A process state consists of the Program Counter value, register contents, and associated memory cell values.

A -- The handout uses the analogy of a music sheet (program) versus the performance of the music (process).

Module 53: Operating Systems: Process and its Administration (Scheduler & Dispatcher)

Q1. Which component of the operating system kernel maintains the process table in main memory to track all active processes?

- A) Scheduler
- B) User Interface Shell
- C) Device Driver
- D) File Manager

Q2. In a time-sharing or multitasking system, what is the short segment of time allocated to each process called?

- A) Time slice
- B) Sector delay
- C) Page fault

D) Hop count

Q3. What signal is generated by a timer circuit to notify the CPU that a process's allocated time slice has expired?

- A) Interrupt
- B) Semaphore
- C) Deadlock
- D) Masking

Q4. What kernel component oversees the execution of scheduled processes and performs context switches between processes?

- A) Dispatcher
- B) Boot loader
- C) Compiler
- D) Assembler

Answer Key

A -- The scheduler maintains the process table in memory, adding new processes and removing completed ones.

A -- Multiprogramming divides execution time into brief segments called time slices.

A -- When a time slice finishes, a timer circuit triggers an interrupt signal to return control to the dispatcher.

A -- The dispatcher allocates CPU time slices to ready processes and manages process switches.

Module 54: Operating Systems: Handling Competition between Processes

Q1. Which operating system component is responsible for allocating mass storage space and file access privileges?

- A) File manager
- B) Dispatcher
- C) Arithmetic Logic Unit
- D) Window manager

Q2. Why is resource allocation in multitasking operating systems a complex task?

- A) Malfunctions can occur if multiple processes demand the same non-sharable resource simultaneously
- B) Modern CPUs cannot perform binary addition
- C) Main memory cannot store integer values
- D) Secondary storage platters rotate in reverse directions

Q3. Which kernel module is responsible for allocating time slots (time slices) to competing processes?

- A) Dispatcher
- B) Memory manager
- C) File manager
- D) Device driver

Q4. What fundamental limitation requires software engineers to design explicit resource allocation algorithms in operating systems?

- A) Computers do not think for themselves and must follow pre-designed instructions for every contingency
- B) Hardware components permanently erase themselves every hour
- C) CPU registers can only process text strings
- D) Peripheral devices communicate only in hexadecimal

Answer Key

- A -- The file manager handles file access permissions and allocates secondary storage space.
- A -- Competition arises when multiple processes request access to non-sharable resources at the same time.
- A -- The dispatcher allocates CPU time slices among ready processes.
- A -- Operating systems must be engineered with algorithms that cover all resource competition scenarios because machines only execute coded directions.

Module 55: Operating Systems: Semaphores

Q1. What term describes a sequence of instructions that should be executed by only one process at a time?

- A) Critical region
- B) Job queue
- C) Interrupt handler
- D) Time slice

Q2. What requirement dictates that only one process at a time be allowed to execute within a critical region?

- A) Mutual exclusion
- B) Paging
- C) Load balancing
- D) Parallel processing

Q3. What is a properly implemented control flag used to guard access to a critical region called?

- A) Semaphore
- B) Vector
- C) Register
- D) Bus

Q4. Which machine-level operation guarantees that checking and setting a flag occurs as an indivisible, un-interruptible step?

- A) Test-and-set instruction
- B) JUMP instruction
- C) LOAD instruction
- D) STORE instruction

Answer Key

- A -- A critical region is a sequence of code instructions that must be accessed by only one process at a time.
- A -- Mutual exclusion is the principle ensuring that multiple processes do not enter a critical region concurrently.
- A -- A semaphore is a synchronization flag used to enforce mutual exclusion around critical regions.

A -- The atomic test-and-set instruction executes testing and setting of a flag in a single machine cycle without interruption.

Module 56: Operating Systems: Deadlock

Q1. What condition occurs when two or more processes are blocked from executing because each is waiting for a resource allocated to another?

- A) Deadlock
- B) Pipelining
- C) Normalization
- D) Truncation

Q2. What is the process of holding data in mass storage for output at a later, more convenient time to make a non-sharable resource appear sharable called?

- A) Spooling
- B) Forking
- C) Masking
- D) Booting

Q3. What UNIX term describes the action of a process creating new processes to perform subtasks?

- A) Forking
- B) Killing
- C) Paging
- D) Tilting

Q4. Which of the following is NOT one of the three required conditions for deadlock to occur?

- A) CPU registers operating in floating-point mode
- B) Competition for non-sharable resources
- C) Resources requested on a partial basis
- D) Allocated resources cannot be forcibly retrieved

Answer Key

A -- Deadlock happens when processes are stuck in a circular wait for resources held by each other.

A -- Spooling temporarily redirects output (such as print jobs) to mass storage, making non-sharable devices appear sharable.

A -- In UNIX, process creation for subtasks is referred to as forking.

A -- Deadlock requires non-sharable competition, partial resource requests, and non-preemptible allocation; CPU floating-point mode is irrelevant.

Module 57: Operating Systems: Security Attacks from Outside

Q1. Who is the highly privileged user responsible for creating accounts, granting permissions, and maintaining operating system settings?

- A) Super user or Administrator
- B) Key punch operator
- C) End user
- D) Client process

Q2. What sequence of transactions allows a user to establish initial contact with an operating system by providing credentials?

- A) Login procedure
- B) Context switch
- C) Machine cycle
- D) Handshaking

Q3. What type of malicious software enters a computer disguised as a desirable program, such as a fake login screen?

- A) Trojan horse
- B) Bus line
- C) Device driver
- D) Router

Q4. What is identified as one of the major human obstacles to computer system security?

- A) Carelessness of users (e.g., weak passwords, sharing passwords, unapproved software)
- B) Using 64-bit microprocessors
- C) Storing files in hierarchical directories
- D) Installing antivirus updates

Answer Key

A -- The super user (or administrator) holds top-level privileges to manage user accounts and system security settings.

A -- A login procedure verifies user identity and grants system access based on stored account rights.

A -- A Trojan horse disguises itself as a legitimate program (such as a fake login prompt) to steal sensitive data.

A -- User carelessness--such as predictable passwords and unapproved downloads--remains a primary security vulnerability.

Module 58: Operating Systems: Security Attacks from Inside

Q1. What special CPU hardware mechanism prevents an unauthorized process from accessing memory cells outside its allotted area?

- A) Memory limit registers (upper and lower limit bounds)
- B) Instruction registers
- C) Parity bit lines
- D) Optical laser sensors

Q2. What mode of CPU operation permits the execution of all machine language instructions, including security-sensitive ones?

- A) Privileged mode
- B) Non-privileged mode
- C) User mode
- D) Asynchronous mode

Q3. What happens if a process running in non-privileged mode attempts to execute a privileged instruction?

- A) An interrupt occurs, switching the CPU to privileged mode and transferring control to an OS interrupt handler

- B) The physical RAM chip is erased permanently
- C) The monitor turns off
- D) The instruction executes without any restriction

Q4. Which CPU instructions are restricted to privileged mode execution only?

- A) Instructions that alter memory limit registers or change execution privilege levels
- B) Basic binary addition (ADD) instructions
- C) ASCII character display routines
- D) Logical AND and OR operations

Answer Key

A -- Memory limit registers store the upper and lower memory boundaries assigned to a process to restrict unauthorized memory access.

A -- Privileged mode allows the CPU to execute every instruction in its machine language set.

A -- Attempting a privileged instruction in non-privileged mode triggers an interrupt, returning control safely to the OS.

A -- Instructions that modify memory limit registers or change CPU privilege modes are restricted to privileged mode.

Module 59: Networking and the Internet: Network Classification

Q1. Which network classification describes a short-range network typically spanning less than a few meters (e.g., Bluetooth headset to smartphone)?

- A) Personal Area Network (PAN)
- B) Wide Area Network (WAN)
- C) Metropolitan Area Network (MAN)
- D) Local Area Network (LAN)

Q2. How is a network classified if its internal designs and standards are in the public domain and freely usable by anyone?

- A) Open network
- B) Proprietary network
- C) Closed network
- D) Pipelined network

Q3. In wireless star network topologies, what central machine coordinates radio communication for surrounding devices?

- A) Access Point (AP)
- B) Bus transceiver
- C) Mainframe accumulator
- D) Disk controller

Q4. Which network topology connects all computers to a single, shared communication line?

- A) Bus topology
- B) Star topology
- C) Ring topology
- D) Mesh topology

Answer Key

A -- A PAN covers short-range personal device communication within a couple of meters.

A -- Open networks (like the TCP/IP Internet) use public standards that require no proprietary license fees.

A -- In wireless star networks, the central Access Point (AP) coordinates all radio broadcast communication.

A -- Bus topology connects all nodes to a common shared communication line.

Module 60: Networking and the Internet: Protocols

Q1. What term refers to the established sets of rules that govern network communication activities?

- A) Protocols
- B) Semaphores
- C) Threads
- D) Schemas

Q2. Which protocol controls message transmission on traditional Ethernet bus networks?

- A) CSMA/CD (Carrier Sense, Multiple Access with Collision Detection)
- B) HTTP
- C) SMTP
- D) ASCII-8

Q3. Why do wireless WiFi networks adopt CSMA/CA (Collision Avoidance) instead of collision detection?

- A) Wireless nodes may be unable to detect collisions due to the hidden terminal problem or signal drowning
- B) WiFi networks do not use radio waves
- C) Wireless signals travel faster than light
- D) Collision detection requires fiber optic cables

Q4. How do some WiFi networks overcome the hidden terminal problem when communicating with an Access Point?

- A) By sending a short request message and waiting for an explicit acknowledgment from the AP before transmitting full data
- B) By increasing CPU clock speed to 4 GHz
- C) By switching to two's complement notation
- D) By disabling all security firewalls

Answer Key

A -- Protocols define the standardized rules that ensure compatible communication across networking hardware.

A -- Ethernet bus networks use CSMA/CD to manage channel access and handle collisions.

A -- Wireless systems use collision avoidance (CSMA/CA) because distant stations cannot always hear each other's transmissions (hidden terminal problem).

A -- Transmitting stations send request frames to the AP and await acknowledgment before transmitting the main data payload.

Module 61: Networking and the Internet: Combining Networks

Q1. Which networking device connects two buses and passes signals back and forth without considering the meaning of the signals?

- A) Bridge
- B) Router
- C) Repeater
- D) Switch

Q2. How does a bridge differ from a repeater when connecting two network buses?

- A) A bridge inspects destination addresses and forwards messages only if destined for a computer on the other side
- B) A bridge converts optical laser signals into analog radio waves
- C) A bridge requires every computer to use two's complement notation
- D) A bridge connects networks with incompatible protocols using IP addresses

Q3. What device acts essentially as a bridge with multiple connections, connecting several buses like spokes on a wheel?

- A) Gateway
- B) Switch
- C) Modem
- D) Access Point

Q4. What special-purpose computer connects autonomous networks with incompatible protocols to form an internet (network of networks)?

- A) Router
- B) Repeater
- C) Switch
- D) Flip-flop

Answer Key

C -- A repeater passes signals between buses with amplification without considering the signal's meaning.

A -- Unlike a repeater, a bridge inspects destination addresses and forwards messages only when meant for the other side.

B -- A switch is essentially a multi-port bridge that connects multiple buses as spokes on a wheel.

A -- Routers are special-purpose computers that connect autonomous, potentially incompatible networks to form an internet.

Module 62: Networking and the Internet: Methods of Process Communication

Q1. In the client/server model of inter-process communication, what is the defining role of a client process?

- A) It continuously runs to satisfy incoming requests
- B) It makes requests of other server processes
- C) It redistributes swarm files among equal peers
- D) It maintains the router forwarding table

Q2. How does the peer-to-peer (P2P) model differ from the client/server model?

- A) Processes in P2P provide service to and receive service from each other as equals

- B) P2P requires a central supercomputer to handle all network traffic
- C) P2P is a physical hardware classification rather than a communication model
- D) P2P servers must run non-stop 24/7

Q3. In P2P file sharing, what term refers to the collection of participating peers sharing pieces of a file?

- A) Cluster
- B) Swarm
- C) Gateway
- D) Bus

Q4. Which of the following is an example of an early client/server application mentioned in the handout?

- A) A print server managing print requests from client machines
- B) Bluetooth pairing between a headset and phone
- C) BOINC scientific calculation grid
- D) Bitcoin blockchain mining

Answer Key

B -- A client process is defined as one that sends service requests to other processes called servers.

A -- In the P2P model, processes communicate as equals, both offering and receiving services.

B -- A swarm is the collection of peers cooperating to distribute file segments among each other.

A -- An early client/server application involved a central print server handling print jobs from multiple client PCs.

Module 63: Networking and the Internet: Distributed Systems

Q1. What type of distributed system consists of independent computers working closely together to provide computation comparable to a large supercomputer?

- A) Cluster computing
- B) Peer-to-peer file sharing
- C) Serial communication
- D) Single-user batch processing

Q2. High-availability and load-balancing are key operational features of which distributed system architecture?

- A) Cluster computing
- B) Access Point hot spots
- C) Analog telephone adapters
- D) ROM boot loaders

Q3. How does grid computing (such as BOINC or Condor) typically operate?

- A) By linking loosely coupled computers, like home PCs, that donate unused computing power to large tasks
- B) By replacing CPU registers with optical disks
- C) By storing entire databases in a single ASCII text file
- D) By running exclusively inside a web browser's title tag

Q4. What modern distributed computing model allows clients to rent huge pools of shared network resources (like virtual servers) on demand?

- A) Cloud computing
- B) Spooling
- C) Hexadecimal conversion
- D) CSMA/CD

Answer Key

A -- Cluster computing connects independent machines closely to achieve supercomputer-like performance with high reliability.

A -- Clusters provide high-availability and load-balancing by shifting tasks among member nodes.

A -- Grid computing links more loosely coupled machines that volunteer idle processing cycles to solve complex problems.

A -- Cloud computing allocates huge pools of shared, rentable network resources to clients on demand.

Module 64: Networking and the Internet: Internet Architecture

Q1. What organizations build, maintain, and operate the system of interconnected networks that form the Internet?

- A) Internet Service Providers (ISPs)
- B) Operating System Kernels
- C) Arithmetic Logic Units
- D) Central Processing Units

Q2. What networks form the top tier (Tier-1) of the Internet architecture hierarchy?

- A) High-speed, high-capacity international WANs acting as the Internet backbone
- B) Local residential WiFi hot spots
- C) Individual desktop computers and smartphones
- D) University campus LANs

Q3. What is an Access ISP (Tier-3 ISP / Intranet)?

- A) An independent network operated by a single authority supplying Internet access to end users
- B) An international submarine fiber optic cable
- C) A specialized CPU instruction register
- D) A software driver for printer devices

Q4. What term describes user devices--such as laptops, smartphones, and smart appliances--that connect to Access ISPs?

- A) End systems (or hosts)
- B) Routers
- C) Bridges
- D) Repeaters

Answer Key

A -- Internet Service Providers (ISPs) construct and maintain the networks constituting the Internet.

A -- Tier-1 ISPs consist of international, high-capacity WANs that serve as the backbone of the Internet.

A -- Access ISPs (or Tier-3 ISPs) provide the intermediary link that connects end users to the Internet core.

A -- Connected user devices (computers, phones, appliances) are referred to as end systems or hosts.

Module 65: Networking and the Internet: Internet Addressing

Q1. What organization is responsible for awarding blocks of consecutive IP addresses to ISPs worldwide?

- A) ICANN (Internet Corporation for Assigned Names and Numbers)
- B) W3C (World Wide Web Consortium)
- C) IEEE
- D) ISO

Q2. How is a 32-bit IPv4 address traditionally written for human readability?

- A) Dotted decimal notation (e.g., 192.207.177.133)
- B) Hexadecimal 2's complement notation
- C) Binary floating-point representation
- D) ASCII text string separated by colons

Q3. In domain name structure (such as mu.edu), what is the suffix .edu called?

- A) Top-Level Domain (TLD)
- B) Subdomain
- C) IP address
- D) Host identifier

Q4. What system converts human-readable mnemonic domain names into numeric IP addresses required for message routing?

- A) Domain Name System (DNS)
- B) Job Control Language (JCL)
- C) Direct Memory Access (DMA)
- D) Dynamic Host Configuration

Answer Key

A -- ICANN coordinates global IP address blocks and domain name registrations.

A -- 32-bit IP addresses are expressed in dotted decimal notation, separating four 8-bit bytes with periods.

A -- Domain suffixes like .edu, .com, and .org are known as Top-Level Domains (TLDs).

A -- The Domain Name System (DNS) performs DNS lookups to translate mnemonic domain names into IP addresses.

Module 66: Networking and the Internet: Internet Applications

Q1. Which traditional network protocol was specifically designed for listing and copying files across a network?

- A) FTP (File Transfer Protocol)
- B) NNTP
- C) SMTP
- D) CSMA/CA

Q2. What protocol was originally used for contacting Usenet news servers to read discussion groups?

- A) NNTP (Network News Transfer Protocol)

- B) HTTP
- C) SSH
- D) DNS

Q3. Which protocol provides encrypted remote login access to another computer over a network?

- A) SSH (Secure Shell)
- B) Telnet
- C) FTP
- D) POP3

Q4. What protocol has increasingly replaced separate traditional network utilities by delivering applications directly through web pages?

- A) HTTP (Hypertext Transfer Protocol)
- B) UDP
- C) JCL
- D) ASCII

Answer Key

A -- FTP (File Transfer Protocol) was designed specifically for listing and transferring files across network hosts.

A -- NNTP (Network News Transfer Protocol) was used by newsreader applications to connect to news servers.

A -- SSH (Secure Shell) replaced Telnet to provide secure, encrypted remote terminal sessions.

A -- HTTP and web browsers have evolved to deliver many traditional network services via web pages.

Module 67: Networking and the Internet: Internet Applications: Email

Q1. What is the standard protocol used for transferring text e-mail messages across the Internet?

- A) SMTP (Simple Mail Transfer Protocol)
- B) HTTP
- C) FTP
- D) IMAP

Q2. Which extension protocol enables e-mail systems to convert non-ASCII elements (like images or attachments) into SMTP-compatible text?

- A) MIME (Multipurpose Internet Mail Extensions)
- B) POP3
- C) DNS
- D) TCP

Q3. How does IMAP differ from POP3 for handling received e-mail messages?

- A) IMAP maintains e-mail messages and folders on the mail server, whereas POP3 downloads them to the local machine
- B) IMAP encrypts hard drives while POP3 formats floppy disks
- C) IMAP works only over Bluetooth networks
- D) POP3 requires floating-point math registers

Q4. Where are e-mail messages stored when using the POP3 protocol?

- A) On the local client machine
- B) Permanently on Tier-1 backbone routers
- C) In nonvolatile CPU ROM
- D) On the ICANN web server

Answer Key

A -- SMTP is the foundational protocol for transmitting text e-mail messages.

A -- MIME converts non-ASCII media into SMTP-compliant text formats for transmission.

A -- IMAP allows users to manage e-mail directly on the server, whereas POP3 downloads messages to local storage.

A -- Under POP3, e-mail messages are downloaded and stored on the user's local machine.

Module 68: Networking and the Internet: VoIP**Q1. What does the acronym VoIP stand for?**

- A) Voice over Internet Protocol
- B) Variable Optical Input Port
- C) Vector Oriented Instruction Process
- D) Virtual Operating Interface Program

Q2. What type of VoIP implementation consists of P2P software on a PC using a microphone and speaker (e.g., Skype)?

- A) Soft phone
- B) Analog telephone adapter
- C) Embedded VoIP handset
- D) 4G cell tower

Q3. What device allows a user to connect a traditional analog telephone to phone service provided by an ISP?

- A) Analog Telephone Adapter (ATA)
- B) Ethernet Switch
- C) Repeater
- D) Optical Laser Pickup

Q4. Why are 4G cell networks considered full VoIP networks?

- A) The 4G infrastructure is entirely IP-based, making smartphones broadband hosts on the Internet
- B) 4G networks do not use radio waves
- C) 4G cell towers require manual pegboard wiring
- D) 4G relies exclusively on ASCII telegraph lines

Answer Key

A -- VoIP stands for Voice over Internet Protocol.

A -- Soft phones use software on personal computers to handle voice calls over P2P connections.

A -- Analog telephone adapters connect conventional phone hardware to an ISP's IP network.

A -- 4G networks operate entirely over IP protocols, treating smartphones as internet hosts.

Module 69: Networking and the Internet: Internet Multimedia Streaming

Q1. What term describes the real-time transportation of audio and video media across the Internet for immediate viewing/listening?

- A) Streaming
- B) Paging
- C) Spooling
- D) Bootstrapping

Q2. Which two major streaming services are highlighted in the source as consuming more than half of total Internet bandwidth?

- A) Netflix and YouTube
- B) Skype and Twitter
- C) Amazon EC2 and BOINC
- D) FTP and Telnet

Q3. How is streaming data communication evaluated in terms of network performance?

- A) By required transmission speed measured in bits per second (bps, Kbps, Mbps)
- B) By CPU clock speed in Gigahertz
- C) By hard drive platter rotation speed (RPM)
- D) By monitor display aspect ratio

Q4. What is a primary challenge associated with live video streaming compared to downloading static files?

- A) It requires a continuous, timely flow of data without long transmission delays
- B) It requires converting all video frames to ASCII text
- C) It erases the computer's operating system kernel
- D) It can only run on 8-bit processors

Answer Key

A -- Streaming refers to transporting audio and video across the Internet in real-time.

A -- Netflix and YouTube together account for over half of all Internet bandwidth consumption.

A -- Streaming performance depends on sustained data transmission rates measured in bps, Kbps, or Mbps.

A -- Real-time streaming requires consistent, timely data delivery to prevent buffering interruptions.

Module 70: Networking and the Internet: World Wide Web

Q1. In a Uniform Resource Locator (URL) such as http://eagle.mu.edu/authors/Shakespeare/Julius_Caesar.html, what component does http represent?

- A) The protocol required to access the document
- B) The mnemonic name of the host computer
- C) The local directory path
- D) The specific document file name

Q2. In the URL example above, what part represents the host computer's mnemonic domain name?

- A) eagle.mu.edu
- B) http
- C) authors/Shakespeare
- D) Julius_Caesar.html

Q3. What hypermedia markup language is used to structure and encode web pages displayed by web browsers?

- A) HTML (Hypertext Markup Language)
- B) SQL
- C) JCL
- D) ASCII-8

Q4. What role does a web browser play when accessing the World Wide Web?

- A) It acts as a client that requests web documents from HTTP servers and displays them on screen
- B) It acts as a router that updates forwarding tables
- C) It acts as a compiler that translates C++ into machine code
- D) It acts as a BIOS chip that boots the computer

Answer Key

- A -- In a URL, http indicates the protocol required to access the target document.
- A -- eagle.mu.edu specifies the mnemonic host domain name holding the document.
- A -- HTML is the standard markup language used to structure web documents.
- A -- Web browsers act as clients fetching web pages from HTTP servers and rendering them for users.

Module 71: Networking and the Internet: Web implementations

Q1. In a Uniform Resource Locator (URL) such as `http://eagle.mu.edu/authors/Shakespeare/Julius_Caesar.html`, what does the prefix `http` specify?

- A) The directory path within the host's file system
- B) The protocol required to access the document
- C) The specific document file name
- D) The IP address of the local router

Q2. What component of the URL `http://eagle.mu.edu/authors/Shakespeare/Julius_Caesar.html` represents the mnemonic name of the host holding the document?

- A) authors/Shakespeare
- B) eagle.mu.edu
- C) Julius_Caesar.html
- D) http

Q3. In the URL structure provided in the handout, what does the segment `authors/Shakespeare` represent?

- A) The top-level domain
- B) The directory path indicating the location of the document within the host's file system
- C) The network interface port number
- D) The encryption protocol algorithm

Q4. What is a primary function of a web browser when accessing documents over the World Wide Web?

- A) Updating router forwarding tables across Tier-1 ISPs
- B) Requesting documents from HTTP servers using URLs and displaying them on screen
- C) Allocating IP addresses to local clients via ICANN
- D) Compiling C++ source code into machine language

Answer Key

- B -- In a URL, http identifies the Hypertext Transfer Protocol needed to retrieve the document.
- B -- eagle.mu.edu specifies the mnemonic domain name of the host computer storing the document.
- B -- authors/Shakespeare forms the directory path indicating the file's location within the server's file system.
- B -- Web browsers act as client applications that fetch documents specified by URLs from HTTP servers and render them for users.

Module 72: Networking and the Internet: HTML**Q1. Which HTML tag surrounds the entire web page source document to indicate its beginning and end?**

- A) <html> and </html>
- B) <body> and </body>
- C) <head> and </head>
- D) <p> and </p>

Q2. What is the function of the <body> and </body> tags in an HTML document?

- A) To define non-visible preliminaries such as document metadata
- B) To enclose the part of the document that will be displayed by a browser
- C) To specify the server's IP address
- D) To establish a connection with the local name server

Q3. Which tag pair is used to format text as a primary heading on a web page?

- A) <p> and </p>
- B) <h1> and </h1>
- C) <title> and </title>
- D) <a> and

Q4. Where is the <title> tag located within a standard HTML document structure?

- A) Inside the <body> section
- B) Inside the <head> section
- C) After the </html> tag
- D) Inside an tag

Answer Key

- A -- The <html> and </html> tags delineate the starting and ending boundaries of an HTML document.
- B -- The <body> tag contains all the text, headings, paragraphs, and images displayed by the web browser.
- B -- <h1> and </h1> format enclosed text as a level-1 heading.
- B -- Document preliminaries such as the <title> reside within the <head> section of an HTML document.

Module 73: Networking and the Internet: HTML

Q1. Which HTML tags, known as anchor tags, are used to create hypertext links between web pages?

- A) <p> and </p>
- B) <a> and
- C) and
- D) <h1> and </h1>

Q2. What attribute parameter inside an opening anchor tag <a> specifies the destination URL of a hyperlink?

- A) src
- B) href
- C) alt
- D) type

Q3. Which HTML tag is used to insert an image into a web page?

- A) <a>
- B)
- C) <picture>
- D) <link>

Q4. What does the src attribute within an tag stand for?

- A) System Resource Code
- B) Source (indicating the location of the image file)
- C) Server Redirect Communication
- D) Symbol Reference Class

Answer Key

B -- Anchor tags <a> and surround text or objects to establish hyperlinks between web documents.

B -- The href (hypertext reference) attribute specifies the target URL linked to the anchor tag.

B -- The tag tells the browser to retrieve and display an image file.

B -- src is short for "source," indicating the URL or file path where the image is stored.

Module 74: Networking and the Internet: More on HTML

Q1. What web reference resource is highlighted in the handout for looking up HTML tags and trying code examples online?

- A) Wikipedia
- B) W3Schools
- C) GitHub
- D) ICANN Directory

Q2. What visual effect does the HTML tag apply to text?

- A) Displays text in italic style
- B) Displays text in bold without extra importance
- C) Underlines the text
- D) Converts text to uppercase

Q3. In W3Schools' "Try it Yourself" editor feature, how is the interface structured?

- A) The source code is on the left side and the rendered output is shown on the right side
- B) The output is displayed in binary while the code is hidden
- C) It compiles C++ code into executable assembly
- D) It opens an MS-DOS command prompt window

Q4. Why are online interactive HTML reference tools useful for learning web development?

- A) They allow developers to test HTML tags and observe real-time browser rendering instantly
- B) They automatically configure router forwarding tables
- C) They assign 128-bit IPv6 addresses to local computers
- D) They replace the need for web servers entirely

Answer Key

B -- The handout directs students to W3Schools (w3schools.com) for comprehensive tag references.

B -- The tag formats enclosed text as bold without adding special semantic weight.

A -- W3Schools' "Try it Yourself" layout demonstrates source code on the left and live browser output on the right.

A -- Interactive editors enable immediate visual feedback when modifying HTML code and parameters.

Module 75: Networking and the Internet: XML**Q1. What standardized notation system style is used for designing text-based markup languages for data representation?**

- A) eXtensible Markup Language (XML)
- B) American Standard Code for Information Interchange (ASCII)
- C) Job Control Language (JCL)
- D) Dynamic Host Configuration Protocol (DHCP)

Q2. XML is a simplified derivative of which older set of standards?

- A) SGML (Standard Generalized Markup Language)
- B) TCP/IP
- C) HTTP
- D) CSMA/CD

Q3. What version of HTML was developed to rigorously adhere to XML standards?

- A) HTML5
- B) XHTML
- C) HTML 2.0
- D) S-HTML

Q4. How do markup languages designed with XML differ from traditional appearance-oriented HTML?

- A) XML allows the creation of tags that emphasize document semantics (meaning) rather than visual layout
- B) XML can only be viewed in text editors without a screen
- C) XML eliminates the use of opening and closing tags
- D) XML is used exclusively for 16-bit integer calculations

Answer Key

- A -- XML is a standardized style for creating custom markup languages to represent text data.
- A -- XML derived as a simplified version of SGML (Standard Generalized Markup Language).
- B -- XHTML is the version of HTML restructured to comply strictly with XML rules.
- A -- XML enables semantic tagging based on meaning (such as marking ingredients or musical notes) rather than screen appearance.

Module 76: Networking and the Internet: Client Side and Server Side

Q1. Where are client-side web scripts (such as JavaScript) executed?

- A) Directly on the end-user's web browser machine
- B) On Tier-1 backbone routers
- C) On ICANN's central domain server
- D) Inside the hard drive controller firmware

Q2. What is a primary purpose of executing client-side scripts within a web application?

- A) Validating user input and creating interactive user interface effects before sending requests to the server
- B) Modifying the server's internal database tables directly
- C) Updating DNS name server registers
- D) Rewriting the computer's BIOS

Q3. Where do server-side activities and scripts (such as PHP or database queries) execute?

- A) On the web server host machine
- B) In the client's local RAM memory
- C) Inside the user's WiFi Access Point
- D) On intermediate network repeaters

Q4. What is a key function performed by server-side processing during web page generation?

- A) Accessing databases, processing business logic, and dynamically constructing customized HTML pages to send to clients
- B) Calculating display monitor screen refresh rates
- C) Converting mouse clicks into sound amplitudes
- D) Formatting local USB flash drives

Answer Key

- A -- Client-side scripts execute within the user's web browser environment on their local machine.
- A -- Client-side scripting enhances responsiveness by handling user interactions and form validation locally.
- A -- Server-side operations run on the web server holding the application resources.
- A -- Server-side programs process requests, query databases, and generate dynamic HTML sent back to client browsers.

Module 77: Networking and the Internet: Layered Approach to Internet Software (I)

Q1. Into how many distinct software layers is Internet communication software structured?

- A) 2 layers
- B) 3 layers
- C) 4 layers

D) 7 layers

Q2. What are the names of the four Internet software layers from top to bottom?

- A) User Layer, System Layer, Hardware Layer, Physical Layer
- B) Application Layer, Transport Layer, Network Layer, Link Layer
- C) File Layer, Memory Layer, CPU Layer, Bus Layer
- D) Session Layer, Presentation Layer, Logic Layer, Media Layer

Q3. In which software layer does a network message typically originate at its source?

- A) Link Layer
- B) Network Layer
- C) Application Layer
- D) Transport Layer

Q4. To illustrate how layered software handles messages, the handout compares Internet software to what real-world process?

- A) A package-shipping system involving sender, shipping company, and airline
- B) A factory assembly line for manufacturing cars
- C) A library book card catalog system
- D) A train station scheduling board

Answer Key

C -- Internet communication software is organized into four hierarchical layers.

B -- The four layers are the Application, Transport, Network, and Link layers.

C -- Messages originate at the Application layer and pass down through the hierarchy for transmission.

A -- The handout uses a package-shipping analogy to explain how software layers hand off data units.

Module 78: Networking and the Internet: Layered Approach to Internet Software (II)

Q1. What is an important task performed by the Transport layer when handling a long message from the Application layer?

- A) Dividing the long message into small segments called packets
- B) Formatting hard drive sectors
- C) Assigning physical MAC addresses to network cards
- D) Displaying visual graphics on screen

Q2. Why does the Transport layer divide long messages into smaller packets before transmission?

- A) To prevent long messages from obstructing the flow of other messages at routers where traffic paths intersect
- B) Because main memory cannot hold more than 1 KB
- C) To convert text characters into ASCII code
- D) Because routers cannot process binary numbers

Q3. What does the Transport layer add to message packets so they can be reassembled in proper order at the destination?

- A) Sequence numbers
- B) Mnemonic domain names

- C) CSS style properties
- D) Bus clock frequencies

Q4. What analogy does the handout use to describe how a single long message obstructs router traffic?

- A) Cars waiting for a long train to pass at a railroad crossing
- B) Water flowing through a pipe
- C) People waiting in a theater ticket line
- D) A stack of books on a desk

Answer Key

- A -- The Transport layer accepts Application messages and chops them into smaller packets.
- A -- Splitting data into packets allows traffic to interleave smoothly at routers without causing long blocks.
- A -- Sequence numbers attached to packets enable the destination Transport layer to reassemble the original message accurately.
- A -- The handout compares long message delays to vehicles delayed by a long train at a railroad crossing.

Module 79: Networking and the Internet: Layered Approach to Internet Software (III)

Q1. Which layer is responsible for maintaining a router's forwarding table and determining the direction a packet should be sent?

- A) Network Layer
- B) Application Layer
- C) Link Layer
- D) Presentation Layer

Q2. What are the ONLY two software layers present on intermediate Internet routers?

- A) Application and Transport layers
- B) Network and Link layers
- C) Transport and Network layers
- D) Application and Link layers

Q3. Which software layer handles actual packet transmission details specific to the local network technology (e.g., CSMA/CD for Ethernet or CSMA/CA for WiFi)?

- A) Link Layer
- B) Network Layer
- C) Transport Layer
- D) Application Layer

Q4. What identifier attached to a message address allows the destination Transport layer to direct the message to the correct application unit?

- A) Port number (e.g., port 80 for HTTP, port 25 for SMTP)
- B) IP address byte
- C) Sector number
- D) TLD suffix

Answer Key

- A -- The Network layer evaluates forwarding tables to decide each packet's routing direction.

B -- Routers only require Network and Link layers because they forward packets without reassembling application messages.

A -- The Link layer manages physical transmission details peculiar to the specific network medium.

A -- Unique port numbers allow the Transport layer to hand reassembled messages to the designated application.

Module 80: Networking and the Internet: TCP /IP Protocol Suite

Q1. Which transport protocol in the TCP/IP suite provides a reliable, connection-oriented service with packet retransmission?

- A) TCP (Transmission Control Protocol)
- B) UDP (User Datagram Protocol)
- C) IP (Internet Protocol)
- D) CSMA/CD

Q2. Why is UDP (User Datagram Protocol) preferred over TCP for applications like DNS lookups and VoIP?

- A) UDP is more streamlined and efficient, making it ideal for time-sensitive transmissions
- B) UDP guarantees zero packet loss
- C) UDP automatically encrypts all messages
- D) UDP does not require IP addressing

Q3. What standard implements the network layer tasks of routing and forwarding in the Internet software suite?

- A) IP (Internet Protocol)
- B) HTTP
- C) ASCII
- D) HTML

Q4. What value appended to an IP packet limits the number of times it can be forwarded, preventing it from circling endlessly in the network?

- A) Hop count (or Time to Live - TTL), with a typical initial value of 64
- B) Port number
- C) Sequence number
- D) Parity bit

Answer Key

A -- TCP is the reliable, connection-oriented transport protocol that retransmits lost packets.

A -- UDP offers high efficiency with low overhead, making it ideal for real-time applications like VoIP and DNS lookups.

A -- IP handles Network layer responsibilities, including packet forwarding and routing.

A -- IP appends a hop count (initial value 64) that decrements at each router to eliminate looping packets.

Module 81: Networking and the Internet: Security (Forms of Attacks)

Q1. Which type of malicious attack is designed to overwhelm a server or network with a flood of requests to disrupt its service?

- A) Denial of Service (DoS) attack

- B) Proxy server filtering
- C) Digital signature verification
- D) Stepwise refinement

Q2. What type of software runs on a computer system to secretly record user activities and report them to an unauthorized third party?

- A) Sniffing software / Spyware
- B) Router forwarding table
- C) Boot loader
- D) Pipelining unit

Q3. Which security threat pretends to be a legitimate program (such as a fake login screen) to trick users into revealing sensitive credentials?

- A) Trojan horse
- B) Repeater
- C) Public key
- D) Function structure

Q4. According to the handout, what is one of the most significant human obstacles affecting computer system security?

- A) User carelessness (such as selecting weak passwords and sharing credentials)
- B) Regularly updating antivirus definitions
- C) Using 64-bit microprocessors
- D) Operating open network protocols like TCP/IP

Answer Key

A -- DoS attacks aim to overwhelm servers or network paths with artificial traffic to disrupt normal operations.

A -- Sniffing software/spyware records user actions on a computer and transmits them to an unauthorized party.

A -- Trojan horses masquerade as legitimate programs to deceive users into providing credentials.

A -- User carelessness--such as choosing predictable passwords and sharing logins--presents a major security obstacle.

Module 82: Networking and the Internet: Protection and Cures

Q1. What software unit acts as an intermediary between a client and a server to shield internal network details and filter incoming traffic?

- A) Proxy server
- B) Program Counter
- C) Operating system kernel
- D) Wi-Fi Access Point

Q2. What primary security advantage does an FTP or HTTP proxy server provide when handling incoming files?

- A) It inspects incoming files for known viruses and blocks infected transmissions
- B) It converts binary data into floating-point numbers
- C) It increases CPU clock speed
- D) It eliminates the requirement for domain name lookups

Q3. What software is used by system administrators to monitor traffic spikes, analyze firewall activity, and detect unusual request patterns?

- A) Auditing software
- B) Compiler
- C) Assembler
- D) Instruction register

Q4. Why must antivirus software be updated regularly by downloading vendor updates?

- A) New computer infections constantly emerge that require updated detection definitions ("vaccines")
- B) To convert ASCII characters into Unicode
- C) To format secondary disk platters
- D) To change the IP address of the local network interface

Answer Key

A -- A proxy server acts as an intermediary between clients and external servers to hide internal details and filter content.

A -- Proxy servers can filter messages from servers to clients, such as blocking virus-infected files.

A -- Auditing software analyzes traffic patterns, firewall logs, and user requests to identify system irregularities.

A -- Antivirus packages require routine updates to recognize newly discovered malware definitions.

Module 83: Networking and the Internet: Encryption

Q1. In public-key cryptography, which key is kept secret by the owner and used to decrypt messages or create digital signatures?

- A) Private key
- B) Public key
- C) Symmetric shared key
- D) Mnemonic key

Q2. What process ensures that a received network message genuinely originated from the party claiming to have sent it?

- A) Authentication
- B) Normalization
- C) Pipelining
- D) Truncation

Q3. How is a digital signature created in public-key encryption systems to mark a message as authentic?

- A) By encrypting the message or bit pattern using the sender's private key
- B) By converting text into HTML tags
- C) By storing the message in an uncompressed ZIP file
- D) By sending the message through a bridge without an IP header

Q4. How does a recipient verify a digital signature attached to an incoming message?

- A) By decrypting the signature using the sender's public key
- B) By requesting a new IP address from ICANN
- C) By executing a while-loop structure
- D) By resetting the CPU instruction register

Answer Key

- A -- The private key is held strictly by its owner to decrypt messages or generate authentic signatures.
- A -- Authentication verifies the true identity of a message's sender.
- A -- A digital signature is created when a sender encrypts data using their private key.
- A -- Recipients decrypt digital signatures using the sender's public key to confirm message authenticity.

Module 84: Networking and the Internet: Legal Approaches to Network Security

Q1. Which major United States federal statute addresses network security and illegal computer intrusions?

- A) Computer Fraud and Abuse Act
- B) Digital Signature Protocol Act
- C) TCP/IP Specification Act
- D) ASCII Standard Ordinance

Q2. Legal approaches to network security primarily focus on which two key issues according to the handout?

- A) Unauthorized access/intrusion and illegal manipulation of computer systems or data
- B) CPU clock frequencies and bus speed
- C) Standardizing HTML anchor tags
- D) Converting binary fractions to decimal

Q3. What is a primary limitation of relying solely on legal legislation to prevent cybercrime?

- A) Passing a law does not physically stop an action from occurring; it merely makes the action illegal
- B) Laws cause computers to execute instructions in reverse order
- C) Legislation automatically disables public-key encryption
- D) Laws apply only to analog telephone lines

Q4. Why must international legal frameworks exist alongside technical measures for network security?

- A) Internet communication spans global boundaries, making cross-border legal cooperation necessary
- B) To force all web browsers to use the same font size
- C) To prevent servers from using proxy units
- D) To eliminate the need for passcodes on smartphones

Answer Key

- A -- The Computer Fraud and Abuse Act is the primary US legislation penalizing unauthorized computer intrusions.
- A -- Network security law focuses on prohibiting unauthorized access and preventing data or system tampering.
- A -- Legal enactments do not physically prevent security breaches; they define legal penalties after violations occur.
- A -- Because networks operate internationally, legal frameworks must address cross-border cybercrime issues.

Module 85: Algorithm: an Informal Review

Q1. In the informal review example of converting kilometers to meters, what is the second step of the algorithm?

- A) Multiply the input by 1000
- B) Divide the input by 100
- C) Add 1000 to the input
- D) Print the word "Kilometers"

Q2. What machine execution loop continues repeating as long as a halt instruction has not been executed?

- A) Fetch, Decode, and Execute
- B) Shift, Rotate, and Mask
- C) Compress, Decompress, and Store
- D) Ping, Route, and Forward

Q3. What do some researchers conjecture regarding human mental activities like decision-making and creativity?

- A) They may ultimately be the result of algorithm execution
- B) They operate exclusively via optical laser signals
- C) They cannot be described using natural language
- D) They require two's complement arithmetic

Q4. Which instruction explicitly stops the execution of an algorithmic procedure?

- A) Halt instruction
- B) Jump instruction
- C) Load instruction
- D) Fetch instruction

Answer Key

A -- The informal kilometer-to-meter conversion algorithm multiplies the kilometer input by 1000.

A -- Processors continuously run the Fetch, Decode, Execute cycle until halted.

A -- Certain researchers hypothesize that human cognitive tasks are forms of algorithm execution.

A -- A halt instruction terminates the step-by-step execution of an algorithm.

Module 86: Algorithm: Formal Definition of Algorithm

Q1. According to the formal definition in CS101, what is an algorithm?

- A) An ordered set of unambiguous, executable steps that defines a terminating process
- B) A collection of physical electronic components inside the computer case
- C) A random collection of machine language instructions stored on disk
- D) An open-source operating system kernel

Q2. What does the requirement that an algorithm's steps be "unambiguous" mean?

- A) Each step's meaning must be clear and lead to a single, precise interpretation
- B) The algorithm must contain at least 100 lines of code
- C) The algorithm can only run on 32-bit processors
- D) The steps must be written in C++ syntax only

Q3. What property ensures that an algorithm will eventually complete its task and stop?

- A) Terminating process

- B) Infinite execution
- C) Cascading rollback
- D) Pipelining stall

Q4. Which of the following is NOT a required characteristic in the formal definition of an algorithm?

- A) Being expressed in a proprietary programming language
- B) Being an ordered set of steps
- C) Being unambiguous and executable
- D) Defining a terminating process

Answer Key

A -- An algorithm is formally defined as an ordered set of unambiguous, executable steps that defines a terminating process.

A -- Unambiguous steps ensure that each instruction has a single, precise interpretation.

A -- The terminating requirement guarantees that an algorithm finishes after a finite number of steps.

A -- Algorithms are abstract entities and do not require a specific proprietary language to exist.

Module 87: Algorithm: Abstract Nature of Algorithms

Q1. To illustrate the distinction between an algorithm and its representation, the handout uses what analogy?

- A) A story (abstract idea) versus a book (physical representation)
- B) A car engine versus gasoline
- C) A monitor screen versus a mouse
- D) A router versus a bridge

Q2. How is a "program" distinguished from an "algorithm" in computer science?

- A) A program is a formal representation of an algorithm designed for computer application
- B) A program is a physical hardware circuit, whereas an algorithm is software
- C) A program cannot be translated into machine language
- D) An algorithm can only run inside a web browser

Q3. What is defined as the dynamic activity of executing a program or algorithm?

- A) Process
- B) Primitive
- C) Syntax
- D) Pseudocode

Q4. What happens when an algorithm representation is translated from one programming language to another?

- A) Only the representation changes; the underlying algorithm remains identical
- B) The algorithm's fundamental logic is permanently altered
- C) The algorithm becomes non-terminating
- D) The process transforms into hardware firmware

Answer Key

A -- The handout compares an abstract algorithm to a story, and its representation to a book.

A -- A program is a formal, specific representation of an algorithm tailored for computer execution.

A -- A process is defined as the active execution of a program or algorithm.

A -- Changing language or format alters only the representation, while the abstract algorithm stays the same.

Lesson 88: Computer Organization: Machine Language (Opcodes)

Q1. What term refers to a well-defined building block used to construct a machine language instruction?

- A) Opcode
- B) Operand
- C) Mnemonic
- D) Assembler

Q2. What is the purpose of an opcode in a machine language instruction?

- A) It specifies the operation to be performed by the CPU
- B) It stores the data value
- C) It holds the memory address
- D) It manages I/O ports

Q3. In the machine language instruction example `0001 0011 1100`, what does the first 4-bit group `0001` represent?

- A) The opcode for LOAD
- B) The memory address
- C) The data value
- D) The parity bit

Q4. Which of the following best describes the relationship between opcodes and assembly language mnemonics?

- A) Mnemonics are human-readable labels that represent opcodes
- B) Opcodes are human-readable labels that represent mnemonics
- C) They are unrelated concepts
- D) Mnemonics are numeric, opcodes are alphabetic

Answer Key

1. A — An opcode is the well-defined building block specifying the operation.
2. A — The opcode tells the CPU which operation to execute.
3. A — The first 4-bit group is the opcode (LOAD).
4. A — Assembly mnemonics are human-readable representations of numeric opcodes.

Lesson 89: Computer Organization: Machine Language (Operands)

Q1. What term refers to the part of a machine language instruction that specifies the data or address?

- A) Operand
- B) Opcode
- C) Mnemonic
- D) Assembler

Q2. In the instruction `0001 0011 1100`, what does `0011 1100` represent?

- A) The operand (memory address or data)
- B) The opcode
- C) The parity check
- D) The interrupt vector

Q3. Which of the following can an operand represent in a machine instruction?

- A) A memory address, a data value, or a register identifier
- B) Only the opcode
- C) Only the program counter
- D) Only the stack pointer

Q4. Why is the operand field necessary in a machine language instruction?

- A) It provides the data or location the operation acts upon
- B) It speeds up the clock
- C) It cools the CPU
- D) It encrypts the opcode

Answer Key

1. A — The operand specifies the data or address.
2. A — The remaining bits form the operand.
3. A — Operands can encode addresses, data, or registers.
4. A — Without an operand the CPU would not know what data to process.

Lesson 90: Algorithm: Representation (Pseudocode) While-Structure

Q1. What pseudocode structure implements the repeated execution of statements as long as a specified condition remains true?

- A) While-structure
- B) If-else structure
- C) Assignment statement
- D) Function header

Q2. What action does the computer take when the test condition in a while-structure evaluates to `true`?

- A) It executes the body of the loop and then returns to re-test the condition
- B) It halts the CPU immediately
- C) It skips the body and proceeds to the next instruction
- D) It deletes the variable from memory

Q3. What happens when the test condition in a while-structure is found to be `false`?

- A) Execution skips the loop body and proceeds to the instruction following the while structure
- B) The computer re-tests the condition indefinitely
- C) A system error interrupt is generated
- D) The Program Counter resets to zero

Q4. In standard pseudocode formatting, how is a while-loop structure typically written?

- A) `while (condition):` followed by an indented body
- B) `if (condition) then halt`

- C) ``def while():``
- D) ``repeat until (false)``

Answer Key

1. A — The while-structure handles repetitive execution dependent on a true condition.
2. A — If the condition is true, the loop body runs and control loops back to check the condition again.
3. A — A false condition terminates the loop, transferring control to the subsequent instruction.
4. A — Pseudocode represents while-loops with ``while (condition):`` followed by the indented loop body.

Lesson 91: Algorithm: Representation (Pseudocode) Function-Structure

Q1. Which Python keyword is adopted in pseudocode to declare a function unit?

- A) `def`
- B) `function`
- C) `defun`
- D) `proc`

Q2. What is the purpose of a function in pseudocode?

- A) To group a sequence of statements into a reusable unit
- B) To declare global variables only
- C) To terminate the program
- D) To import external libraries

Q3. Which of the following is a valid pseudocode function header?

- A) ``def calculate_sum(a, b):``
- B) ``function calculate_sum(a, b)``
- C) ``calculate_sum = function(a, b)``
- D) ``proc calculate_sum(a, b);``

Q4. What does the ``return`` statement do in a pseudocode function?

- A) It sends a value back to the caller and exits the function
- B) It restarts the function from the beginning
- C) It prints the value to the screen
- D) It deletes the function from memory

Answer Key

1. A — Pseudocode borrows Python's ``def`` keyword to declare functions.
2. A — Functions group statements into reusable units.
3. A — ``def calculate_sum(a, b):`` is the valid header format.
4. A — Return sends a value back to the caller and exits.

Lesson 92: Algorithm: Discovery (The Art of Problem Solving)

Q1. Who formulated the four-step problem-solving process?

- A) Alan Turing
- B) George Polya
- C) Donald Knuth

D) Edsger Dijkstra

Q2. What is the correct order of Polya's four steps?

- A) Understand the problem, Devise a plan, Carry out the plan, Look back
- B) Devise a plan, Understand the problem, Look back, Carry out the plan
- C) Carry out the plan, Look back, Understand the problem, Devise a plan
- D) Look back, Carry out the plan, Devise a plan, Understand the problem

Q3. What does Polya's first step require?

- A) Writing code immediately
- B) Fully understanding the problem before attempting a solution
- C) Testing with random data
- D) Optimizing for speed

Q4. What does Polya's fourth phase involve?

- A) Documenting the code
- B) Evaluating the solution to verify its correctness
- C) Deleting the source code
- D) Publishing the results

Answer Key

1. B — George Polya formulated the four-step process.
2. A — The order is: Understand, Devise a plan, Carry out, Look back.
3. B — First fully understand the problem before solving.
4. B — Look back means verifying the solution's correctness.

Lesson 93: Algorithm: Getting your Foot in the Door

Q1. What does the problem-solving strategy "getting your foot in the door" mean?

- A) Obtaining an initial foothold on a problem to begin expanding toward a complete solution
- B) Installing physical security locks on server room doors
- C) Writing 1000 lines of code without testing
- D) Terminating a process immediately using a halt instruction

Q2. What is required from the problem solver to expand an initial foothold into a complete algorithmic solution?

- A) Creative input
- B) Converting all variables to 16-bit floating-point numbers
- C) Purchasing proprietary software licenses
- D) Increasing CPU clock speed

Q3. How does starting with a simplified version of a problem help a programmer?

- A) It provides a manageable starting point from which the full problem can be approached
- B) It automatically removes all syntax errors from C++ code
- C) It bypasses the need for loop control testing
- D) It guarantees that the solution is lossless

Q4. "Getting your foot in the door" encourages an approach that avoids which common mistake?

- A) Trying to conquer an entire complex task in all its detail all at once
- B) Using functions declared with def
- C) Storing integers in two's complement form
- D) Reading file directories sequentially

Answer Key

1. A — "Getting your foot in the door" refers to making an initial breakthrough on a problem to work toward a full solution.
2. A — Expanding an initial toehold into a complete algorithm requires creative input from the problem solver.
3. A — Solving a simplified form of a problem provides a clear entry point for tackling the full complexity.
4. A — It prevents designers from becoming overwhelmed by attempting to solve every complex detail simultaneously.

Lesson 94: Algorithm: Algorithm Discovery Strategies (I)

Q1. What is the "divide and conquer" strategy in algorithm discovery?

- A) Breaking a large problem into smaller, manageable subproblems
- B) Dividing the CPU into multiple cores
- C) Splitting memory into partitions
- D) Separating code into files

Q2. Which of the following is an example of "working backwards" as a discovery strategy?

- A) Starting from the desired solution and determining the steps to reach it
- B) Writing code from bottom to top
- C) Reversing the bits in a byte
- D) Running the program in reverse

Q3. What does the "look for a related problem" strategy suggest?

- A) Finding a similar problem that has already been solved and adapting its solution
- B) Searching the internet for code to copy
- C) Asking a friend to solve it
- D) Ignoring the problem

Q4. Why are discovery strategies important in algorithm design?

- A) They provide systematic approaches to tackle complex problems
- B) They make the code run faster automatically
- C) They eliminate the need for testing
- D) They guarantee optimal solutions

Answer Key

1. A — Divide and conquer breaks complex problems into smaller subproblems.
2. A — Working backwards starts from the goal and works toward the initial state.
3. A — Related problems offer templates for new solutions.
4. A — Strategies give designers systematic methods for problem-solving.

Lesson 95: Algorithm: Algorithm Discovery Strategies (II)

Q1. What is "stepwise refinement" in algorithm discovery?

- A) Gradually breaking down a high-level operation into detailed steps
- B) Polishing the computer case
- C) Upgrading the CPU step by step
- D) Refining oil into gasoline

Q2. Which of the following best describes "top-down design"?

- A) Starting with a general solution and breaking it into sub-tasks
- B) Starting with code and guessing the problem
- C) Designing the hardware first
- D) Writing the main function last

Q3. What is the benefit of stepwise refinement?

- A) It makes complex algorithms easier to understand and implement
- B) It makes programs run 10x faster
- C) It reduces the need for variables
- D) It eliminates loops

Q4. In stepwise refinement, when do you stop breaking down steps?

- A) When each step is simple enough to be implemented directly
- B) When you run out of paper
- C) After exactly 5 levels
- D) Never; continue indefinitely

Answer Key

1. A — Stepwise refinement decomposes high-level operations into detailed steps.
2. A — Top-down design starts general and refines into specifics.
3. A — Refinement aids comprehension and implementation.
4. A — Stop when steps are directly implementable.

Lesson 96: Algorithm: Iterative Structures (Sequential Search Algorithm)

Q1. What is the sequential search algorithm?

- A) Checking each element in a list one by one until the target is found
- B) Sorting the list before searching
- C) Using binary division to find elements
- D) Searching only the first element

Q2. What is the worst-case time complexity of sequential search?

- A) $O(n)$
- B) $O(1)$
- C) $O(\log n)$
- D) $O(n^2)$

Q3. When is sequential search most appropriate?

- A) When the list is unsorted or small
- B) When the list is very large and sorted
- C) When you need guaranteed logarithmic time
- D) Never; it's obsolete

Q4. What does the sequential search return if the target is not found?

- A) A "not found" indication (e.g., -1 or null)
- B) The first element
- C) A random element
- D) It crashes

Answer Key

1. A — Sequential search examines elements one by one.
2. A — Worst case checks all n elements: $O(n)$.
3. A — Best for small or unsorted lists.
4. A — Returns a sentinel indicating failure.

Lesson 97: Algorithm: Iterative Structures (Loop Control)**Q1. What is the primary purpose of iterative structures in algorithms?**

- A) To handle repetitive execution of instruction sequences
- B) To store data permanently
- C) To display output on screen
- D) To connect to the internet

Q2. What happens if loop control is faulty in an iterative structure?

- A) It can prevent the termination condition from being met, causing an infinite loop
- B) The program runs faster
- C) Nothing happens
- D) The computer shuts down

Q3. In pseudocode, which statement structure is commonly used to implement iterative control?

- A) ``while`` loop structure
- B) ``if-else`` selection structure
- C) ``import`` statement
- D) ``return`` statement

Q4. What component of a loop evaluates whether repetitive execution should continue or stop?

- A) The test condition
- B) The frame rate
- C) The bit mask
- D) The domain name

Answer Key

1. A — Iterative structures handle repetitive execution of instruction sequences.
2. A — Faulty loop control can prevent the termination condition from being met, causing an infinite loop.
3. A — The ``while`` loop structure is the primary pseudocode construct for iterative processing.
4. A — The test condition evaluates state variables to decide whether to repeat or exit the loop.

Lesson 98: Algorithm: Iterative Structures (Components of Repetitive Control)

Q1. What three essential activities make up successful loop control?

- A) Initialize, Test, and Modify
- B) Fetch, Decode, and Execute
- C) Load, Store, and Add
- D) Compress, Transmit, and Decompress

Q2. What is the role of the "Initialize" activity in loop control?

- A) To establish the starting values for variables involved in the loop condition
- B) To print the final result on screen
- C) To halt program execution
- D) To clear the instruction register

Q3. What is the condition watched by the test activity to stop looping called?

- A) Termination condition
- B) Overflow condition
- C) Interrupt condition
- D) Handshaking condition

Q4. What occurs if the "Modify" activity is omitted from a loop body?

- A) The state variables never change, preventing the termination condition from being reached and causing an infinite loop
- B) The loop executes exactly once and stops
- C) The program converts integers to floating-point numbers
- D) The compiler generates an automatic repair

Answer Key

1. A — Loop control strictly requires three activities: initialize, test, and modify.
2. A — Initialization sets up the starting state of loop variables prior to the first test.
3. A — The termination condition is what the test activity watches to stop looping.
4. A — Without modification, variable values remain static, causing the test condition to never change and resulting in an infinite loop.

Lesson 99: Algorithm: Iterative Structures: Loop Execution (Examples-1)

Q1. In the `FindMax` algorithm example, what initial value is assigned to the variable `max`?

- A) The first number in the list
- B) Zero
- C) The last number in the list
- D) A random 8-bit integer

Q2. In the `FindMax` algorithm, which variable holds the second number of the list at the start of loop execution?

- A) `Current`
- B) `max`
- C) `n`
- D) `Result`

Q3. What comparison condition is evaluated inside the loop in the `FindMax` algorithm?

- A) `If (max < Current)`
- B) `If (max == 0)`
- C) `If (Current == 0)`
- D) `If (max > 100)`

Q4. What action is taken inside the `FindMax` loop if `max` is found to be smaller than `Current`?

- A) `max` is updated to take the value of `Current`
- B) The algorithm halts immediately
- C) `Current` is set to zero
- D) The list entries are sorted in reverse order

Answer Key

1. A — In FindMax, `max` starts as the first number in the list.
2. A — The `Current` variable holds the next number being examined.
3. A — The loop tests `If (max < Current)`.
4. A — When Current is larger, max is updated to Current's value.

Lesson 100: Algorithm: Iterative Structures: Loop Execution (Examples-II)

Q1. In the algorithm example designed to compute the factorial of a number n ($n!$), what initial value should the product accumulator variable hold?

- A) 1
- B) 0
- C) n
- D) 2

Q2. Why is a factorial accumulator initialized to 1 instead of 0?

- A) Multiplying any number by 0 would result in a product of 0
- B) 1 is the sign bit in two's complement
- C) Memory cell address 0 is reserved for the OS kernel
- D) Factorials can only be calculated using odd numbers

Q3. What mathematically defines the factorial of a positive integer n (written as $n!$)?

- A) The product of all positive integers from 1 up to n
- B) The sum of all integers from 0 to n
- C) n raised to the power of 2
- D) The remainder when n is divided by 2

Q4. How does the modify step operate in a typical iterative factorial algorithm?

- A) It decrements or increments a counter variable toward the termination bound in each iteration
- B) It clears all CPU registers
- C) It shifts bits circularly to the right
- D) It executes a JUMP instruction to address C000

Answer Key

1. A — The product accumulator for calculating factorials must be initialized to 1.

2. A — Initializing to 0 would cause all subsequent multiplications in the loop to yield 0.
3. A — Factorial $n!$ is defined as the product of all positive integers from 1 through n .
4. A — The modify step adjusts the loop counter toward the termination threshold with each pass.

End of Quiz

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