MTH601 Midterm Exam Solved Paper 2005 – Operations Research
SEMESTER SPRING

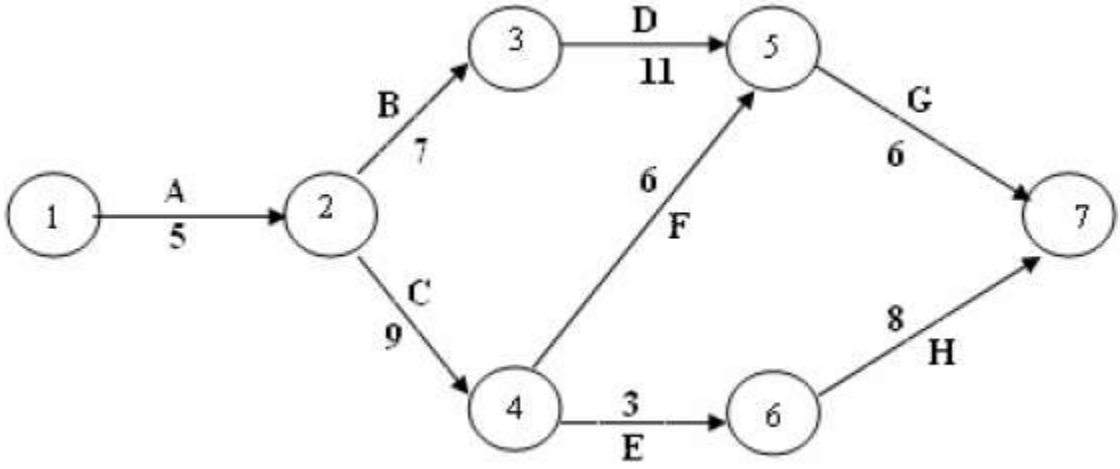
www.vuzs.net

quiz.vuzs.net

Total Marks = M= 50

Duration: 90mins

MTH601 - Operations Research - Q. No. 1 M -10
For the following project diagram find out Earliest start time (EST), Earliest finish time (EFT), Latest start time (LST), Latest finish time (LFT) for each activity. Also find the Critical Path.



NOTE: There is no need of making diagram corresponds to each step, you have to write down only the required terms correspond to each activity and the justification for the critical path.

Solution:

Activity	EST	EFT	LST	LFT
A(1 – 2)	0	5	0	5
B(2 – 3)	5	12	5	12
C(2 – 4)	5	14	8	17
D(3 – 5)	12	23	12	23
E(4 – 6)	14	17	18	21
F(4 – 5)	14	20	17	23
G(5 – 7)	23	29	23	29
H(6 – 7)	17	25	21	29

To find the **Critical Path** we'll find the Slack (Float) of each activity.

Activity	Slack
A(1 – 2)	0
B(2 – 3)	0
C(2 – 4)	3
D(3 – 5)	0
E(4 – 6)	4
F(4 – 5)	3
G(5 – 6)	0
H(6 – 7)	4

MTH601 - Operations Research - Q. No. 2 M -10
Suppose the following estimates of activity times of a project,

Activity	Optimistic Time	Most Likely Time	Pessimistic Time
A	1	2	3
B	3	6	8
C	5	8	20
D	10	13	28
E	4	7	12
F	2	4	5
G	8	12	16
H	2	2	2

If the critical path of the project is A, D, G, H, then calculate the Expected Completion Time (Length of the path) and corresponding Variance of the project.

Solution:

Critical Activities	Optimistic Time (t_0)	Most Likely Time (t_m)	Pessimistic Time (t_p)	Expected Duration (t_e)	Variance
A	1	2	3	2	0.11
D	10	13	28	15	9
G	8	12	16	12	1.78
H	2	2	2	2	0

Expected Completion time $= 2 + 15 + 12 + 2$
$= 31$
Variance (of the project) $= 0.11 + 9 + 1.78 + 0$
$= 10.89$

http://www.vuzs.net/study-portals/bscs-study-portal.html

MTH601 - Operations Research - Q. No. 3 M -10
Demand for the product is 600 units per year, and the items are withdrawn at a constant rate. The setup cost for placing an order to replenish inventory is $25. The unit cost of each item is $3, and the inventory holding cost is $0.05 per item per week.

(a). Assuming shortages are not allowed, determine how often to make a production run and what size it should be.

(b). If shortages are allowed but cost $2 per item per month, determine how often to order and what size the order should be.

Solution:

www.vuzs.net

D=600 unit/year
Ordering Cost (C_2) = $25/order
Item Cost (C_1) = $3/item
Holding Cost (C3) = 0.05/item/week
= 0.05*52/item/year
=2.6/item/year
(a). Shortages are not allowed:
Q* =?
t* = ?

$$Q^* = \sqrt{2C_2D/C_3}$$

Putting all the values in the above formula we have

$$Q^* = \sqrt{2*25*600/2.6}$$

$$Q^* = 107.42$$

$$t^* = Q^*/D$$
$$= 107.41/600$$
$$= 0.1796$$

(b). Shortages are allowed:
Shortage Cost (C_4) = $2 /item/month
= 24 item/year

$$Q^* = \sqrt{2C_2D/C_3} * \sqrt{(C_3+C_4)/C_4}$$
$$= 107.41 * \sqrt{(2.6+24)/24}$$
$$= 223.606$$

$$t^* = Q^*/D$$
$$= 0.3726$$

MTH601 - Operations Research - Q. No. 4 M -10

Rabbani and Sons of Sialkot manufacture sports goods like hockey sticks, cricket bats etc .Each hockey stick yields a profit of Rs.20 and each cricket bat Rs 25.A hockey stick requires four hours of processing at machine A and two hours at machine B. A bat requires six hours of processing at machine A and five hours at machine Band one hour at machine C. Machine A has a maximum of 135 hours of availability capacity, machine B has 75 hours and machine C has 20 hours.

Read the above problem carefully and formulate it as an LP model to maximize the company's profit.

Solution:

Decision variables

x1 = Number of hockey stick

x2 = number of cricket bats

Objective function

Since each hockey stick yields a profit of Rs.20 so x1 number of hockey stick yields a profit of Rs.20x1

Since each cricket bat yields a profit of Rs 25 x2 number of cricket bats yields a profit of Rs.25x2

As we want to maximize the company profit so objective function is

Maximize Z = 20x1 + 25x2

Constraints

Product	Machine A	Machine B	Machine C
Hockey	4	2	0
Bat	6	5	1

Hourly Availability of machine A = 135

Hourly Availability of machine B = 75

Hourly Availability of machine C = 20

$4x1 + 6x2 \leq 135$

$2x1 + 5x2 \leq 75$

$0x1 + x2 \leq 20$

$x1, x2 \geq 0$

Now LP problem is

Maximize Z = 20x1 + 25x2

Subject to

$4x1 + 6x2 \leq 135$

www.vuzs.net

$2x1 + 5x2 \leq 75$

$0x1 + x2 \leq 20$

$x1, x2 \geq 0$

MTH601 - Operations Research - Q. No. 5 M -10

Select the best choice (Only one) from the given four choices against each question.

1. _____ employs a different modeling and solution logic than linear programming

(a). Transportation Model

(b). Inventory Control Model

(c). Dynamic Programming

(d). None of the above

2. To identify and maintain the proper precedence relationship between activities those are not connected by

event, we introduce

(a). Parallel Activity

(b). Dummy Activity

(c). Sequential Activity

(d). None of the above

3. EST and EFT of activities are calculated in

(a). Forward pass

(b). Backward pass

www.vuzs.net

4. Critical path is obtained by connecting the jobs having

(a). Activities having same EST and LST

(b). Activities having same EFT and LFT

(c). Activities having zero slack

(d). All of the above

5. The Variance Vt of expected time is calculated as

- Vt = (tm – t0 / 6)^2
- **Vt = (t0 – tp / 6)^2**
- Vt = (tp – tm / 6)^2
- None of the Above

6. In LP problems Additivity means that

(a). The effect of two different programs of production is the same as that of a joint program

(b). The doubling (or tripling) the product will exactly double (or triple) the profit and the required resource

(c). Both (a)& (b)

(d). None of the above

7. Two of the first steps of OR process encompass the actual use of OR techniques. These steps are

(a). Model Construction and Model Solution

(b). Observation and Implementation

(c). Definition of the problem and Model Solution

(d). Model Solution and Implementation of results

http://www.vuzs.net/study-portals/bscs-study-portal.html

www.vuzs.net

8. Let FS = Free Slack, TS = Total Slack, INDS = Independent Slack, then which relation is true

(a). TS ≤ FS

(b). INDS ≤ FS

(c). FS ≤ TS

(d). Both (b) & (c)

9. Best possible time estimate that a given activity would take under normal conditions which often exist, is called

(a). Most Likely time estimate

(b). Pessimistic time estimate

(c). Smallest time estimate

(d). None of the above

10. Standard Deviation S.D is

(a). One sixth of the difference between pessimistic time estimates and optimistic time estimates

(b). One sixth of the difference between pessimistic time estimates and most likely time estimates

(c). One sixth of the difference between optimistic time estimates and most likely time estimates

(d). One sixth of the difference between most likely time estimates and optimistic time estimates

www.vuzs.net