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MTH202 Assignment 1 Solution - Dr. Imran Talib

Fall 2026

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MTH202: Discrete Structures

Assignment No. 1 — Fall 2026 | Total Marks: 20

Section Incharge: Dr. Imran Talib

Lectures 1 to 10. Due Date: 9 November 2026.

Question 1 (5 Marks)

Construct a truth table to verify that $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$.

The table below gives both sides side by side.

p	q	p → q	q → p	(p → q) ∧ (q → p)	p ↔ q
T	T	T	T	T	T
T	F	F	T	F	F
F	T	T	F	F	F
F	F	T	T	T	T

In each of the four rows the fifth column and the sixth column hold the same value. So the two sides are equal, and the statement is proved.

Question 2 (a) (2 Marks)

If Ali submits his assignment, he receives feedback. Ali does not receive feedback. Therefore, Ali did not submit his assignment. Write the argument in symbols and check whether it is valid.

Let p stand for Ali submits his assignment and q stand for Ali receives feedback. Then the argument has the form $p \rightarrow q$, $\sim q$, so $\sim p$. This form is Modus Tollens. Modus Tollens is valid, so the argument is valid.

Question 2 (b) (3 Marks)

A switching circuit consists of switch P connected in series with a parallel combination of switches Q and R. Write the logical expression for the circuit and find when the bulb lights.

Switch P is in series with the parallel pair Q and R. The bulb lights exactly when P is closed and at least one of Q and R is closed. So the logical form is $P \wedge (Q \vee R)$.

P	Q	R	Q ∨ R	P ∧ (Q ∨ R)
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	F	F

The bulb is on in three rows: P and Q closed, P and R closed, and all three closed.

Question 3 (5 Marks)

Prove the identity (A − B) ∪ (A ∩ B) = A using set laws. Name the law used at each step.

Start from the left side and use one set law at each step.

(A − B) ∪ (A ∩ B)

= (A ∩ B′) ∪ (A ∩ B) Difference Law

= A ∩ (B′ ∪ B) Distributive Law

= A ∩ U Complement Law

= A Identity Law

The left side comes out equal to A, so the identity is proved.

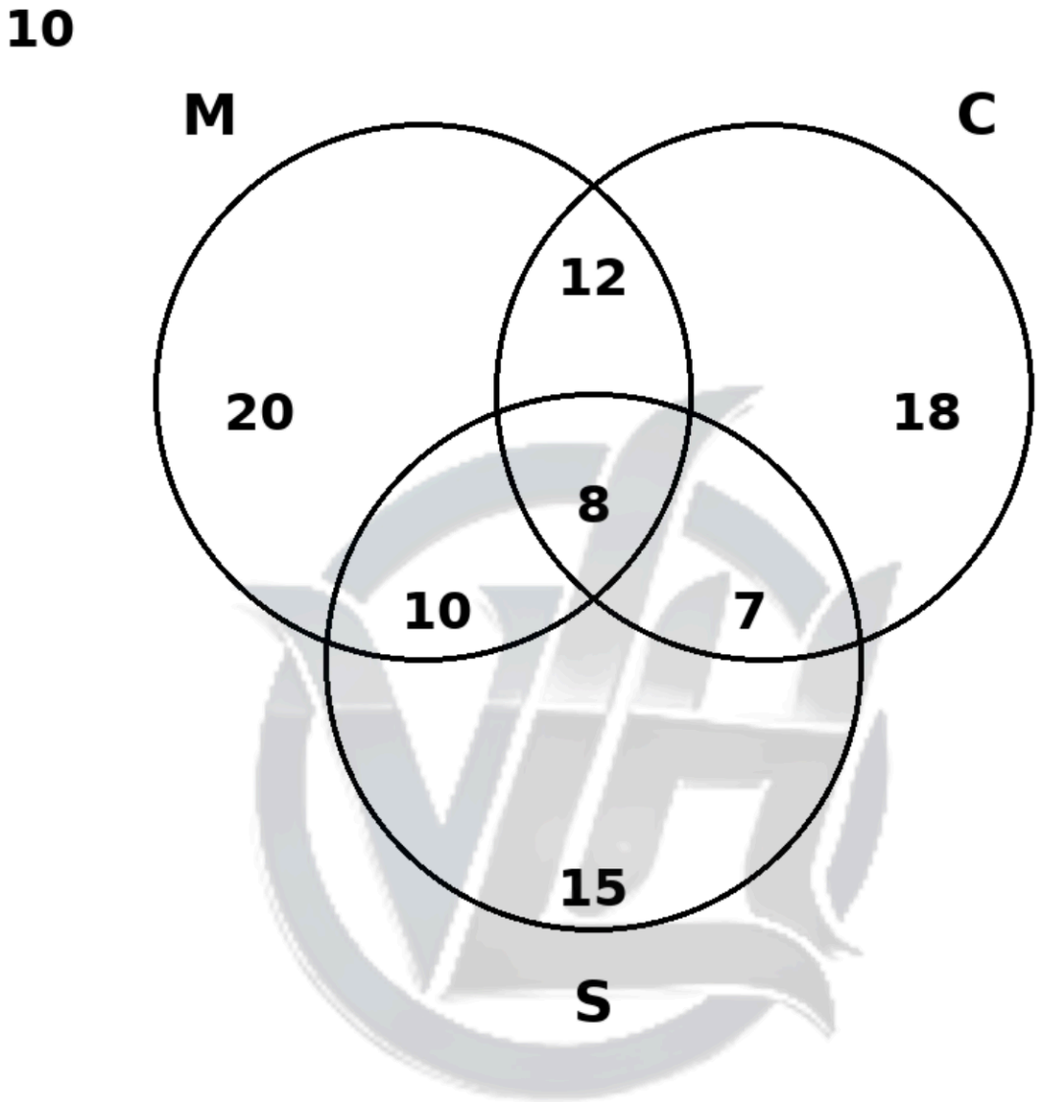
Question 4 (5 Marks)

A survey of 100 students asked about three clubs: Mathematics (M), Computing (C) and Science (S). The survey gives 50 students in Mathematics, 45 in Computing and 40 in Science. The pairs M and C, M and S, C and S hold 20, 18 and 15 students. All three clubs hold 8 students.

The pairs include the students in all three clubs, so 8 is taken out of each pair first. The students in exactly two clubs are 20 − 8 = 12, 18 − 8 = 10 and 15 − 8 = 7. The students in only one club are 50 − 12 − 10 − 8 = 20, 45 − 12 − 7 − 8 = 18 and 40 − 10 − 7 − 8 = 15. The students in no club

are $100 - 90 = 10$.

(a) Venn Diagram



Region	Students
Mathematics only	20
Computing only	18
Science only	15
Mathematics and Computing only	12
Mathematics and Science only	10
Computing and Science only	7
All three clubs	8
Outside all three clubs	10
Total	100

(b) Exactly One Club

Add the three only-one regions: 20 + 18 + 15 = 53.

(c) Exactly Two Clubs

Add the three exactly-two regions: 12 + 10 + 7 = 29.