University of Colombo, Sri Lanka

UCSC *University of Colombo School of Computing*

BIT

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2021 — 1^{st} Year Examination — Semester 2

IT2106 — Mathematics for Computing I

Multiple Choice Question Paper

(2 Hours)

Important Instructions

- The duration of the paper is **2 Hours**.
- The medium of instructions and questions is English.
- This paper has **40 questions** on **9 pages**. Answer **all** questions.
- All questions are of the **MCQ** (Multiple Choice Questions) type.
- Each question will have **5 (five)** choices with one or more correct answers.
- This paper consists of 100 marks and all the questions will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from -1 (All the incorrect choices are marked & no correct choices are marked) to +1 (All the correct choices are marked & no incorrect choices are marked). However, **the minimum mark per question would be zero**.
- Answers should be marked on the **special answer sheet** provided.
- Note that questions appear on both sides of the paper. If a page is not printed, please inform the supervisor/invigilator immediately.
- Mark the correct choices on the question paper first and then transfer them to the given answer sheet which will be machine marked. **Please completely read and follow the instructions given on the other side of the answer sheet before you shade your correct choices.**
- Calculators are **not** allowed.
-

Notations:

Z – set of integers N – set of positive integers
R – set of real numbers ∅ - (null) empty set
U - Universal set R^+ - set of positive real numbers

1) Which of the following is/are equal to $x^{\frac{p}{q}}$

(a) $\left(x^{\frac{1}{q}}\right)^{p}$.	(b) $\left(x^{\frac{1}{q}}\right)^{\frac{1}{p}}$.	(c) $\left(x^{\frac{1}{p}}\right)^{\frac{1}{q}}$.	(d) $\sqrt[q]{x^{p}}$.	(e) $\left(x^{\frac{p^2}{q}}\right)^{\frac{1}{p}}$.

2) $\dfrac{x^3y^2z}{x^2yz^3}$ is equal to

(a) xyz^{-2}	(b) $x^{-1}y^{-1}z^{2}$	(c) $x^5y^3z^4$	(d) $\frac{x^{-1}y^{-1}}{z^{-2}}$	(e) $\frac{xy}{z^2}$

3) $\log_4 32$ is equal to

(a) 2.5 .	(b) $\log_2 4 - \log_2 8$.	(c) $\frac{\log_2 4}{\log_2 8}$.	(d) $\frac{2}{3}$.	(e) $1 + \frac{\log_2 8}{\log_2 4}$.

4) Which of the following is/are correct?

(a) $\forall a, u, v \in N \text{ and } a \neq 1, \log_a uv = \log_a u + \log_a v$.
(b) $\forall a, u, v \in N \text{ and } a \neq 1 \log_a uv = \log_a u - \log_a v$.
(c) $\forall a \in N \setminus \{1\}, \log_a 1 = 0$.
(d) $\forall a \in N \setminus \{1\}, \log_a 1 = 1$.
(e) $\forall a, u, v \in N \text{ and } a \neq 1 \log_a uv = (\log_a u)(\log_a v)$.

5) Let A = {x | x ∈ R and $2x^2$-3x+1=0 } and B = {x | x ∈ R and x^2+5x - 6=0 }.

A ∩ B is equal to

(a) {1}.	(b) {2}.	(c) {3}.	(d) {1,2}.	(e) {1,2,3} .

6) Let N be the set of all natural number set. A = {0} ∪ {-n | n ∈ N}.

A ∪ N is equal to

(a) N.	(b) Z.	(c) A.	(d) N\{-1}.	(e) N ∪ {-n | n ∈ N}.

7) The sets A and B are such that $A \setminus B \neq \varnothing$. Which of the following is/are possible?

(a) $A \subseteq B$. (b) $A \neq B$. (c) $A = B$. (d) $B \subseteq A$. (e) $A = \varnothing$.

8) Let A and B be two non-empty **disjoint** sets. Which of the following is/are **not** true?

(a) $A^c \cup B^c = (A \setminus B)^c \cap A$. (b) $A^c \cup B^c = (A \cap B)^c$. (c) $A^c \cup B^c = (A \setminus B)^c \cup A$
(d) $A^c \cup B^c = (A \setminus B)^c \cup B$. (e) $A^c \cup B^c = (B \setminus A)^c \cup B$.

9) Let A and B be any two non-empty sets. If A is a proper subset of B, which of the following **must** be true?

(a) $A \cap B = A$. (b) $A \cup B = A$ (c) $B \subset A$.
(d) $A \cup B = B$. (e) $A \cap B = \varnothing$.

10) Let A,B and C be three non-empty sets. Which of the following is/are not correct?

(a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$. (b) $A \cup (B \cap C) = (A \cap B) \cup (A \cap C)$.
(c) $A \cup (B \cap C) = (B \cup A) \cap (C \cup A)$. (d) $A \cup (B \cap C) = (B \cap A) \cup (C \cap A)$.
(e) $A \cup (B \cap C) = A \cap (B \cup C)$.

11) Let X and Y be two sets. Which of the following is/are correct?

(a) $X \cup Y = \{a \mid a \in X \wedge a \in Y\}$. (b) $X \cup Y = \{a \mid a \in X \vee a \in Y\}$.
(c) $X \cap Y = \{a \mid a \in X \wedge a \in Y\}$. (d) $X \cap Y = \{a \mid a \in X \vee a \in Y\}$.
(e) $(X \cup Y)^c = \{a \mid a \notin X \wedge a \notin Y\}$.

12) $((A \cap C) \cap B)$ is **not** equal to

(a) $(A \cap C) \setminus B^c$ (b) $(A \cap B) \setminus C^c$ (c) $(B \cap C) \setminus A^c$
(d) $(A \cap C) \setminus A$ (e) $(A \cap B) \setminus A$

13) Let A={ x,y,z} and B={ y, w }. Which of the following is/are valid propositions?

(a) $x \notin B$. (b) $A \cap B \neq \varnothing$. (c) $A \subseteq A$.
(d) Is B a sub set of A? (e) Find the complement of A.

14) Which of the following propositions is/are logically equivalent to $(p \leftrightarrow q)$?

(a) $(p\rightarrow q) \wedge (q \rightarrow p)$.	(b) $(p \wedge \sim q) \vee (\sim p \wedge \sim q)$.
(c) $(p\rightarrow q) \vee (q \rightarrow p)$.	(d) $(\sim p \vee q) \wedge (\sim q \vee p)$.
(e) $\sim(p\rightarrow q) \vee \sim(q \rightarrow p)$.	

15) Let p and q be two propositions. Which of the following is/are **not** tautologies?

(a) $(\sim p \vee q) \leftrightarrow \sim(p \wedge \sim q)$.	(b) $(p \rightarrow q) \leftrightarrow \sim(p \wedge q)$.
(c) $(\sim p \vee q) \leftrightarrow (p \rightarrow q)$.	(d) $(\sim p \wedge q) \leftrightarrow \sim(p \wedge \sim q)$.
(e) $(p \rightarrow q) \leftrightarrow (\sim p \wedge q)$	

(16) Which of the following arguments is/are valid?

(a) $p \rightarrow q, p \vdash q$	(b) $p \vee q, \sim p \vdash \sim q$	(c) $p \Rightarrow q, \sim q \vdash p$
(d) $\sim p \vee q, p \vdash \sim q$	(e) $p \vee q, \sim p \vdash q$	

(17) Which sets of the following statements is/are consistent?

(a) $p \wedge q, p \vee q, \sim p$	(b) $p \vee q, \sim p, q$	(c) $\sim(q \rightarrow p), q, \sim p$
(d) $\sim(q \rightarrow p), q, p$	(e) $\sim(q \rightarrow p), \sim q, \sim p$	

18) Consider the following truth tables for two different non-equivalent propositions **P1** and **P2** of one variable p.

p	**P1**	**P2**
T	**T**	**F**
F	**T**	**F**

Which of the following propositions correctly represents **P1, P2** respectively.

(a) $p \vee \sim p, \sim(p \vee \sim p)$	(b) $p \vee \sim p, p \wedge p$
(c) $p \vee p, p \wedge p$	(d) $p \vee \sim p, p \wedge \sim p$
(e) $\sim(p \vee \sim p), p \wedge \sim p$	

19) Let $p(x)$ be a predicate defined on D, where $D=\{x_1, x_2, x_3, \ldots, xn\}$. If $\forall x\ p(x)$ is true, which of the following is/are true?

(a) $p(x_1) \wedge p(x_2) \wedge \ldots \wedge p(xn)$.
(b) $\exists x \sim p(x)$.
(c) $p(x_1) \vee p(x_2) \vee \ldots \vee p(xn)$.
(d) $\exists x\ p(x)$.
(e) $\sim p(x_1) \vee \sim p(x_2) \vee \ldots \vee \sim p(xn)$ is false.

20) Let $p(x)$ be a predicate defined on a domain D. If $\forall x\ p(x)$ is false, which of the following **MUST** be true?

(a) There is x_0 in D for which $p(x_0)$ is false.
(b) For every x in D, $p(x)$ is false.
(c) For every x in D, $\sim p(x)$ is true.
(d) There are no elements in D for which $p(x)$ is true.
(e) $\exists x\ p(x)$ is false.

21) Let $p(x)$: $x-1 < 1$ and $q(x)$: $x+1 \geq 3$ be two predicates of the variable x defined on N.

Which of the following propositions is/are true?

(a) $\forall x\ (p(x) \wedge q(x))$
(b) $\forall x\ (p(x) \vee q(x))$
(c) $\forall x\ p(x)$
(d) $\exists x\ (p(x) \vee q(x))$
(e) $\exists x\ (p(x) \wedge q(x))$

22) Suppose $x \in \{5, 20, 30, 40\}$ and $y \in \{6, 12, 16, 24, 50\}$. Which of the following propositions is/are true?

(a) $\forall x\ \exists y\ \ x < y$.
(b) $\forall y\ \exists x\ \ x < y$.
(c) $\exists x\ \forall y\ \ x < y$.
(d) $\exists x\ \exists y\ \ x < y$.
(e) $\forall x\ \forall y\ \ x < y$.

23) Let $p(x)$ be a predicate defined on a domain D. Which of the following is/are equivalent to $\sim\forall x\ p(x)$?

(a) $\forall x\ p(x)$. (b) $\exists x \sim p(x)$. (c) $\forall x \sim p(x)$. (d) $\sim\forall x \sim p(x)$. (e) $\sim\exists x \sim p(x)$.

24) Let $X = \{3, 4, 6\}$, $Y=\{1, 2, 8, 9\}$, $\alpha=\{(x,y) \mid x\in X, y\in Y, x < y\}$.

Which of the following belong(s) to α?

(a) (6,3).
(b) (6,2).
(c) (6,9).
(d) (6,8).
(e) (3,2).

25) Let α and β be two relations defined by
$\alpha = \{(x,y) \mid x \in Z, y \in Z, x \leq y\}$ and $\beta = \{(x,y) \mid x \in Z, y \in Z, x > y\}$.

Which of the following is/are **not** true?

(a) α and β are not symmetric.
(b) α and β are reflexive.
(c) α is symmetric and β is not symmetric.
(d) α is reflexive and β is not reflexive.
(e) α is transitive and β is not transitive.

26) Let α be a relation defined on Z by $\alpha = \{(x,y) \mid x \in Z, y \in Z, x \leq y\}$.

What is α^{-1}?

(a) $\alpha^{-1} = \{(x,y) \mid x \in Z, y \in Z, y > x\}$.
(b) $\alpha^{-1} = \{(x,y) \mid (y,x) \in \alpha\}$.
(c) $\alpha^{-1} = \{(x,y) \mid x \in Z, y \in Z, x > y\}$.
(d) $\alpha^{-1} = \{(x,y) \mid x \in Z, y \in Z, \sim(x < y)\}$.
(e) $\alpha^{-1} = \{(x,y) \mid x \in Z, y \in Z, x \geq y\}$.

27) Let α be a relation defined on a non-empty set D by $\alpha = \{(x,y) \mid x,y \in D\}$. Then α is said to be symmetric if and only if

(a) $\forall x\ (x,x) \in \alpha$.
(b) $\forall x \forall y \forall z\ (x,y) \in \alpha \wedge (z,y) \in \alpha \rightarrow (x,z) \in \alpha$.
(c) $\forall x \forall y\ (x,y) \in \alpha \rightarrow (y,x) \in \alpha$.
(d) $\exists x, x \in D(\alpha) \wedge (x,x) \in \alpha$.
(e) $\forall x \forall y\ (x,y) \notin \alpha \vee (y,x) \in \alpha$.

28) Suppose $A = \{10,15,20\}$.
If $\alpha = \{(x,y) \mid x,y \in A, x < y\}$ and $\beta = \{(x,y) \mid x,y \in A, n \in N, y = nx\}$,

which of the following is/are true?

(a) $\beta \circ \alpha = \{(10,15),(10,20),(15,20)\}$.
(b) $\beta \circ \alpha = \{(10,15),(10,20)\}$.
(c) $\beta \circ \alpha = \{(10,10),(10,20),(15,20)\}$.
(d) $\beta \circ \alpha = \{(10,20)\}$.
(e) $\beta \circ \alpha = \beta$.

29) Let ρ be the relation defined on A={a,b,c} by

ρ={(a,a),(b,b),(c,c),(a,b),(b,a),(b,c),(c,b),(a,c),(c,a)}.

Find $[a]_\rho \cap [b]_\rho$.

(a) {a,b}.	(b) {b,c}.
(c) $\varnothing$.	(d) {a,c}.
(e) A.	

30) Let f be a function defined on A={1,2,3}. Which of the following do/does not represent f?

(a) $f(1)=10, f(2)=10, f(3)=10$.	(b) $f(1)=8, f(2)=8, f(3)=10$.
(c) $f(1)=7, f(1)=8, f(2)=9, f(3)=10$.	(d) $f(1)=8, f(2)=9$.
(e) $f(1)=1, f(2)=2, f(3)=3$.	

31) Suppose g is a 1-1 function and $x,y \in D(g)$. Which of the following is/are correct about g?

(a) $\forall x \forall y \; x \neq y \Rightarrow g(x) = g(y)$.
(b) $\forall x \forall y \; \sim(x = y) \Rightarrow \sim(g(x) = g(y))$.
(c) $\forall x \forall y \; g(x) = g(y) \Rightarrow x = y$.
(d) $\forall x \forall y \; \sim(g(x) = g(y)) \Rightarrow x \neq y$.
(e) $\exists x \exists y \sim(x = y) \wedge g(x) = g(y)$.

32) Let the functions f and g be defined by $f(x) = 2x-1$ and $g(x) = 3x+1$ where $x \in R$.
Then $(f \, o \, g)(x)$ is equal to

(a) 6x-3.
(b) 6x-2.
(c) 6x+1.
(d) 3x-1.
(e) 3x-2.

33) Let the 6-tuple <B,+,*, c,0,1> be a Boolean algebra where B is a set, + and * the sum and the product operators respectively, 0 and 1 the zero and the unit elements respectively and c the complement operator.

If b is an element of the set B, what is/are the dual of the Boolean expression b + 1 = 1?

(a) b * 1 = 1.	(b) b * 0 = 0.	(c) b + 0 = 0.
(d) b * A = A.	(e) b * 1 = 1.	

34) Find the number of arrangements that can be made by taking all the letters in the word "COMMITTEE" ?

(a) $\dfrac{6!}{(2!)(2!)(2!)}$ (b) $\dfrac{9!}{(2!)(2!)(2!)}$ (c) $\dfrac{9!}{8}$ (d) $\dfrac{9!}{4!}$ (e) $(2!)(2!)(2!)$

35) The sample space refers to

(a) any particular experimental outcome.
(b) sample size.
(c) the sample size minus one .
(d) space between two samples.
(e) the set of all possible experimental outcomes.

36) An experiment consists of three steps. There are two possible results on the first step, three possible results on the second step, and four possible results on the third step. The total number of possible experimental outcomes is:

(a) 9 (b) 10 (c) 18 (d) 24 (e) 36

37) In an examination, students can select three subjects out of many subjects. The following information is given on the subjects STATS and IT and MATHS.

50% of students take STAT

20% take IT and STATS but not MATHS

5% take IT and MATHS but not STAT

90% take at least one of STATS, IT and MATHS

10% take STATS and MATHS but not IT

10% take only STAT

45% take MATHS

The percentage of students who take **only** IT is

(a) 5%	(b) 10%	(c) 15%
(d) 20%	(e) 25%	

38) If A and B are independent events with $P(A) = 0.4$ and $P(B) = 0.75$, then $P(A \cup \bar{B})$ is:

(a) 0.10	(b) 0.55	(c) 0.65	(d) 0.75	(e) 0.85

39) A six-sided fair die numbered from 1 to 6 and a four-sided fair die numbered from 1 to 4 are rolled simultaneously. The probability of getting a total of two face values is 4 or less given that both-face values are different is:

(a) $\frac{2}{20}$	(b) $\frac{4}{20}$	(c) $\frac{4}{24}$	(d) $\frac{6}{24}$	(e) $\frac{20}{24}$

40) If 40% of boys opted for maths and 20% of girls opted for maths, then what is the probability that maths is chosen if one fourth of the class's population are girls??

(a) 0.25	(b) 0.30	(c) 0.35	(d) 0.60	c (e) 1.00

****