UCSC

BIT

UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2020 – 1st Year Examination – Semester 2

IT2106 - Mathematics for Computing I

(TWO HOURS)

Important Instructions :

- The duration of the paper is 2 (two) hours.
- The medium of instruction and questions is English.
- The paper has **40** questions and **7** pages.
- All questions are of the MCQ (Multiple Choice Questions) type.
- All questions should be answered.
- Each question will have 5 (five) choices with **one or more** correct answers.
- All questions carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from 0 (All the incorrect choices are marked & no correct choices are marked) to +1 (All the correct choices are marked & no incorrect choices are marked).
- 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 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.**

Notations:

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

1) Which of the following is/are equal to $\sqrt[3]{x^2}$?

(a) $x^{\frac{3}{2}}$	(b) $x^{\frac{2}{3}}$	(c) $\left(x^{\frac{1}{3}}\right)^2$	(d) $\left(x^{\frac{1}{2}}\right)^3$	(e) $\left(x^{\frac{1}{3}}\right)^{\frac{1}{2}}$

2) $x^{-1}y^{-1}z^2$ is equal to which of the following?

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

3) $\log_9 27$ is equal to which of the following?

(a) $\frac{2}{3}$	(b) $\frac{3}{2}$	(c) $\frac{\log_3 9}{\log_3 27}$	(d) $\frac{\log_3 27}{\log_3 9}$	(e) $\log_3 27 - \log_3 9$

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

5) Let X = {x | x ∈ R and x^2-2x+1=0 } and Y = {y | y ∈ R and y^2-1=0 }. What is X ∩ Y ?

(a) {-1}	(b) {1}	(c) ∅	(d) {1,-1}	(e) 1

6) Let Z be the set of integers, N be the set of positive integers and A={-n | n ∈N}.
What is Z\N ?

(a) Z.	(b) {0}.	(c) {0}∪A.	(d) A.	(e) N.

7) Let A and B be two non-empty sets. If A ⊆ B, which of the following **must** be **false**?

(a) A \ B = ∅	(b) B \ A = ∅	(c) A ∩ B = ∅	(d) A ∩ B ≠ ∅	(e) A=B

8) Let A and B be two non-empty **disjoint** sets. Which of the following **must** be **false**?

(a) $A \setminus B = \varnothing$	(b) $B \setminus A = B$	(c) $A \cap B = \varnothing$	(d) $(A \setminus B) \cap (B \setminus A) \neq \varnothing$	(e) $A=B$

9) Let U be the universal set and A be a non-empty subset of it . Which of the following **must** be **false**?

(a) $\varnothing \subseteq A$.	(b) $A^c = U$.	(c) $A^c \neq U$.	(d) $A^c \subseteq U$	(e) $A^c \subset U$

10) Let X and Y be any two non-empty sets. If $X \subset Y$, which of the following **must** be true?

(a) $X \subseteq Y$.	(b) $Y \subseteq X$.	(c) $Y \setminus X \neq \varnothing$	(d) $Y \subset X$	(e) $X \neq Y$

11) Let A,B and C be three non-empty sets. Which of the following is/are **false**?

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

12) Let A,B and C be any three non-empty sets. Which of the following is/are true about A?

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

13) Let A and B be two sets. Which of the following is/are correct?

(a) $A \cup B = \{x \mid x \in A \wedge x \in B\}$.
(b) $A \cup B = \{x \mid x \in A \vee x \in B\}$.
(c) $A \cap B = \{x \mid x \in A \wedge x \in B\}$.
(d) $A \cap B = \{x \mid x \in A \vee x \in B\}$.
(e) $A \cup B \subseteq A \cap B$.

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

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

15) Let p and q be two propositions. Which of the following is/are **contradictions**?

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

16) Let p and q be two propositions. Which of the following arguments is/are **invalid**?

(a) $p \vee q, \sim p \vdash q$	(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) $p \rightarrow q, p \vdash q$	

17) Let p and q be two propositions. Which of the following arguments is/are **valid**?

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

18) Which of the following sets of statements is/are inconsistent?

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

19) Let $D=\{x_1, x_2, x_3, \ldots\ldots, x_n\}$ and the predicate $p(x)$ is defined on D. If $\exists x\, p(x)$ is true, which of the following **must** be true?

(a) $\exists x\, p(x)$.	(b) $p(x_1)$.	(c) $\forall x\, p(x)$.
(d) $\exists x \sim p(x)$.	(e) $\forall x \sim p(x)$.	

20) Let $D=\{x_1, x_2, x_3, \ldots\ldots, x_n\}$ and the predicate $p(x)$ is defined on D. If $\exists x\, p(x)$ is **false**, which of the following **must** be true?

(a) $\sim\exists x \sim p(x)$.	(b) $\forall x\, p(x)$.	(c) $\sim p(x_1)$.
(d) $\sim\exists x\, p(x)$.	(e) $\forall x \sim p(x)$.	

21) Let $p(x): x \leq 0$ and $q(x): x \geq 0$ be two predicates of the variable x defined on Z. Which of the following propositions is/are true?

(a) $\forall x\, [p(x) \vee q(x)]$.	(b) $\forall x\, [p(x) \wedge q(x)]$.	(c) $p(0) \wedge q(0)$.
(d) $\sim p(0) \vee \sim q(0)$.	(e) $\exists x\, [p(x) \wedge q(x)]$.	

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

23) Let X = {3, 4, 6} , Y={1, 2, 8, 9}, $\alpha = \{ (a, b) \mid a \leq b \wedge a \in X \wedge b \in Y \}$. Which of the following belong to α?

(a) (3,4).	(b) (9,9).	(c) (4,2).	(d) (2,3)	(e) (6,8)

24) Let α and β be two relations defined by
$\alpha = \{ (a, b) \mid a \geq b \wedge a, b \in Z \}$ and $\beta = \{ (a, b) \mid a^2 = b^2 \wedge a, b \in Z \}$.
Which of the following is/are true?

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

25) Let α be a relation defined on Z by $\alpha = \{(a, b) \mid b = a + 2 \wedge a, b \in Z \}$. Find α^{-1}.

(a) $\alpha^{-1} = \{(x,y) \mid y = x + 2 \wedge x,y \in Z \}$.	(b) $\alpha^{-1} = \{(x,y) \mid (y,x) \in \alpha\}$.
(c) $\alpha^{-1} = \{(x,y) \mid x = y - 2 \wedge x,y \in Z \}$.	(d) $\alpha^{-1} = \{(x,y) \mid y = x - 2 \wedge x,y \in Z \}$.
(e) $\alpha^{-1} = \{(x,y) \mid x = y + 2 \wedge x,y \in Z \}$.	

26) Let α be a relation defined on a non-empty set D such that it is reflexive. Which of the following is/are true?

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

27) Let α be the relation defined on A={x,y} by $\alpha = \{(x,x),(y,y),(x,y),(y,x)\}$. Find $[y]_\alpha$.

(a) {x}.	(b) {y}.	(c) {x,y}.	(d) { }.	(e) A.

28) Which of the following is/are equivalence relation(s)?

(a) $\{ (a, b) \mid a \leq b \wedge a, b \in Z \}$.	(b) $\{ (a, b) \mid a \geq b \wedge a, b \in Z \}$.
(c) $\{ (a, b) \mid a^2 = b^2 \wedge a, b \in Z \}$.	(d) $\{ (a, b) \mid b = a + 2 \wedge a, b \in Z \}$.
(e) $\{ (a, b) \mid b = a - 2 \wedge a, b \in Z \}$.	

29) Let X={2,4,6}, Y={3,6,9} and f be a relation from X to Y. Which of the following define(s) a function?

(a) $f(2)=9, f(4)=9, f(6)=9$.	(b) $f(2)=9, f(4)=2, f(6)=6$.
(c) $f(2)=9, f(2)=3, f(4)=9, f(6)=6$.	(d) $f(2)=9, f(4)=6$.
(e) $f(2)=3, f(4)=3, f(6)=3$.	

30) Suppose f is a function defined on A. Which of the following **must be false**?

(a) $D(f) \subseteq A$, $R(f) \subseteq A$.	(b) $D(f) \subset A$, $R(f) \subseteq A$.	(c) $D(f) \subseteq A$, $A \subset R(f)$.
(d) $D(f) = A$, $R(f) \subseteq A$.	(e) $D(f) = A$, $R(f) = A$.	

31) Suppose f is a 1-1 function. Which of the following is/are true?

(a) $\forall x \forall y\ \ x \neq y \Rightarrow f(x) = f(y)$.
(b) $\forall x \forall y\ \ f(x) = f(y) \Rightarrow x = y$.
(c) $\forall x \forall y\ \ \sim(f(x) = f(y)) \Rightarrow x \neq y$.
(d) $\sim(\exists x\ \exists y \sim(x = y) \vee f(x) = f(y))$.
(e) $\forall x \forall y\ \ \sim(x = y) \Rightarrow \sim(f(x) = f(y))$.

32) Let f and g be functions defined by $f(x) = 2x-1$ and $g(x) = 3x$ where $x \in R$.
Then $(f\ \boldsymbol{o}\ g)(1)$ is equal to which of the following?

(a) 3.	(b) 5.	(c) 6.	(d) 1.	(e) 0.

33) Let f be a function defined on R by $f(x) = 2(x+1)$. Which of the following is/are true?

(a) f is 1-1.
(b) $D(f^{-1})$=R, $f^{-1}(x) = \frac{1}{2} + 1$.
(c) f^{-1} does not exit.
(d) $D(f^{-1})$=R, $f^{-1}(x) = \frac{1}{2}(x-1)$.
(e) $D(f^{-1})$=R, $f^{-1}(x) = \frac{1}{2}x - 1$.

34) What is the number of arrangements that can be made by taking all the letters in the word "COMPOSITION" if the three letters "O" are together?

(a) $\frac{9!}{(2!)}$.	(b) $\frac{9!}{(2!)(3!)}$.	(c) $\frac{9!}{2}$.	(d) $\frac{9!}{26}$.	(e) $\frac{11!}{(2!)(3!)}$.

35) When the occurrence of one event has no effect on the probability of the occurrence of another event, the events are called:

(a) Independent events.	(b) Dependent events.	(c) Equally likely events.
(d) Exhaustive events.	(e) Mutually exclusive events.	

36) Two fair coins are tossed simultaneously. If one of them turned head, what is the probability that the other one turn tail?

(a) 0.01.	(b) 0.05.	(c) 0.25.	(d) 0.5.	(e) 1.

37) Two six-sided fair dice are rolled simultaneously. The probability of getting a total of 4 or less given that both-faces are similar is:

(a) $\frac{2}{36}$.	(b) $\frac{3}{36}$.	(c) $\frac{6}{36}$.	(d) $\frac{1}{6}$	(e) $\frac{2}{6}$

38) If A and B are two events such that $P(\bar{A} \cap B) = 5/12$, $P(A) = 1/3$, then $P(\bar{A} \cap \bar{B})$ is:

(a) $\frac{1}{2}$	(b) $\frac{1}{4}$	(c) $\frac{3}{4}$	(d) $\frac{1}{12}$	(e) $\frac{7}{12}$

39) A box contains 10 marbles, of which 7 are green and 3 are white. A marble is picked at random from the box and its colour is noted. Without replacing the first marble a second marble is then picked out. What is the probability that the first marble is green and the second marble is white?

(a) $\frac{21}{100}$.	(b) $\frac{7}{30}$.	(c) $\frac{3}{10}$.	(d) $\frac{1}{3}$.	(e) 1.

40) What is the probability that in a random arrangement of the letters of the word "UNIVERSITY", the two I's do not come together?

(a) $\frac{1}{10}$	(b) $\frac{1}{5}$	(c) $\frac{3}{10}$	(d) $\frac{4}{5}$	(e) $\frac{9}{10}$

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