UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2017 – 1st Year Examination – Semester 2

IT2105 - Mathematics for Computing I

11th November 2017

(TWO HOURS)

Important Instructions :

- The duration of the paper is 2 (two) hours.
- The medium of instruction and questions is English.
- The paper has **43** questions and **9** 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 will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from 0 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	$\varnothing$ - (null) empty set
S – Universal set	R^+- set of non-negative real numbers

1) Find $(\boldsymbol{x^6y^3z})^{\mathbf{1}/\mathbf{3}}$ when $x = 10, y = 2, z = 27$

(a) 60	(b) 120	(c) 600	(d) 180	(e) 6000

2) $\dfrac{16^{\frac{1}{4}}\times 3^2}{27^{\frac{2}{3}}}$ is equal to

(a) 2	(b) $\frac{4}{27}$	(c) 1.	(d) $\frac{2}{27}$	(e) 4.

3) $(-2) + \log_3 36$ is equal to

(a) $\log_3 9$.	(b) $\log_3 4$.	(c) $2\ \log_3 2$.
(d) 0 .	(e) 2 .	

4) Suppose the universal set is S={1,2,3,4,5,6,7,8,9,10}. Let A = {1,4,8,9} and B= {3, 4, 6, 9, 10}. Consider the following:

(i) $A^c \cup B = \{2,3,4,5,6,7,9,10\}$

(ii) $A^c \cap B = \{3,6,10\}$

(iii) $A^c \setminus B = \{2,5\}$

Then

(a) only (i) and (ii) are true.	(b) only (i) is true.	(c) only (ii) is true.
(d) (i), (ii) and (iii) are **all** true.	(e) only (iii) is **false**.	

5) Let A and B be two non-empty sets. Which of the following are/is true?

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

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

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

7) If $A = \{(a, b) \mid a,b \in Z,\ 2a + b = 3\}$, and $B = \{(a, b) \mid a, b \in Z,\ 7a + b = 8\}$,

$A \cap B$ is equal to

(a) $\{(1,-1)\}$	(b) $\{(-1,1)\}$	(c) $\{(1, 1)\}$
(d) $\{(-1, -1)\}$	(e) $\varnothing$	

8) $A = \{-2, -1, 0\} \cup N$ and $B = \{2, 1, 0\} \cup \{-n \mid n \in N\}$.

Which of the following are/is true?

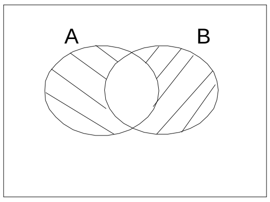
(a) $A \setminus B = \{n \mid n \in N \text{ and } n > 2\}$ and $B \setminus A = \{-n \mid n \in N \text{ and } n > 2\}$.
(b) $A \setminus B = \{n \mid n \in N \text{ and } n > 2\}$ and $B \setminus A = \{ n \mid n \in Z \text{ and } n < -2\}$.
(c) $A \setminus B = \{-2, -1, 0\}$ and $B \setminus A = \{-n \mid n \in N \text{ and } n > 2\}$.
(d) $A \setminus B = \{n \mid n \in N \text{ and } n > 2\}$ and $B \setminus A = \{2, 1, 0\}$.
(e) $A \setminus B = \{-2, -1, 0\}$ and $B \setminus A = \{2, 1, 0\}$.

9) Let A be any non-empty set. If P(A) is the power set of A, which of the following is/are true?

(a) $\{A\} \subset P(A)$. (b) $\varnothing \in P(A)$ (c) $|P(A)| = 2^{|A|}$. (d) $P(A) \cap \{A\} = P(A)$.

(e) $P(A) \cap \{A\} = \{A\}$.

10) Consider the following Venn diagram.



The shaded portion in the Venn diagram represents

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

11) Let A and B be any two non-empty sets. Which of the following is/are **not** (a) proposition(s)?

(a) The word "LION" has no vowels.	(b) $A \cap A^c = \varnothing$.	(c) $A \subseteq B$
(d) Check your index number.	(e) $A = \varnothing$.	

12) Consider the following truth tables for four different propositions of one variable ***p***.

p	P1	P2	P3	P4
T	T	T	F	F
F	T	F	T	F

Which of the following gives four such propositions P1, P2, P3, P4 respectively.

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

13) Suppose you left home and found that your office key is not with you. You know that the following statements are true.

i) If my office key is on the kitchen table, I saw it at breakfast.
ii) I was reading the newspaper in the living room or the kitchen.
iii) If I was reading the newspaper in the living room, my office key is on the coffee table.
iv) I did not see my office key at breakfast.
v) If I was reading the newspaper in the kitchen, my office key is on the kitchen table.

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

(a) My office key is on the kitchen table.
(b) My office key is not on the coffee table.
(c) I was reading the newspaper in the kitchen.
(d) I was reading the newspaper in the living room.
(e) My office key is on the coffee table.

14) Which of the following set(s) of statements is/are **inconsistent**?

(a) $\{ p \wedge q, p \vee q, \sim p \}$
(b) $\{ p \vee q, \sim p, \sim q \}$
(c) $\{ q \Rightarrow p, p \Rightarrow \sim r, q, r \}$
(d) $\{ q \Leftrightarrow p, \sim p, \sim q \}$
(e) $\{ q \Rightarrow p,\ p \Rightarrow \sim r,\ r \}$

15) Which of the following are/is logically equivalent to $(p \Rightarrow q) \wedge (q \Rightarrow p)$?

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

16) Which of the following arguments is a/are **fallacy/fallacies**?

(a) $p \Rightarrow q, p \vdash \sim q$
(b) $p \Rightarrow q, \sim q \vdash \sim p$
(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 D={x_1, x_2, x_3,........, x_n }. If p(x) is a predicate defined on the set D and $\forall x\ p(x)$ is false, which of the following is/are true?

(a) $p(x_1) \vee p(x_2) \vee .....\vee p(x_n)$ **must** be true.
(b) $\sim p(x_1) \vee \sim p(x_2) \vee .....\vee \sim p(x_n)$ **must** be true.
(c) $p(x_1)\wedge p(x_2)\wedge .....\wedge p(x_n)$ **must** be false.
(d) $p(x_1) \vee p(x_2) \vee .....\vee p(x_n)$ **must** be false.
(e) $\sim p(x_1)\wedge \sim p(x_2)\wedge .....\wedge \sim p(x_n)$ **must** be true.

18) Let D={x_1, x_2, x_3,........, x_n }. If p(x) is a predicate defined on the set D and $\exists x\ p(x)$ is false, which of the following is/are true?

(a) $p(x_1) \vee p(x_2) \vee .....\vee p(x_n)$ **must** be true.
(b) $\sim p(x_1) \vee \sim p(x_2) \vee .....\vee \sim p(x_n)$ **must** be true.
(c) $p(x_1)\wedge p(x_2)\wedge .....\wedge p(x_n)$ **must** be false.
(d) $p(x_1) \vee p(x_2) \vee .....\vee p(x_n)$ **must** be false.
(e) $\sim p(x_1)\wedge \sim p(x_2)\wedge .....\wedge \sim p(x_n)$ **must** be true.

19) Let the two predicates p(x) and q(x) be defined as p(x): $x < 1$ and q(x): $x >= 1$ where $x \in R$.

Which of the following propositions are/is true?

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

20) Let *p* and *q* be two atomic propositions. Which of the following is a/are tautology/ies involving p and q?

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

21) Let p and q be propositions. Which of the following is/are correct?

(a) $(p \wedge \sim p) \vee \sim q$ is a contradiction.	(b) $(p \vee \sim p) \wedge \sim q$ is a contradiction.
(c) $(p \vee \sim p) \wedge q$ is a tautology.	(d)$(p \wedge \sim p) \vee (q \vee \sim q)$ is a tautology.
(e) $(p \vee \sim p) \vee q$ is a tautology.	

22) Let A={1, 2,7, 9}, B={3,8}, α={(x,y)| $x\in A$, $y \in B$, $x > y$}.

Which of the following belongs to α?

(a) (7,3).	(b) (8,1).	(c) (2,1).
(d) (9,8).	(e) (9,9).	

23) Let A and B be two non-empty sets and α be a relation defined from A onto B.

Which of the following **must** be true?

(a) $D(\alpha)=A$	(b) $D(\alpha) \subset A$
(c) $R(\alpha)=B$	(d) $R(\alpha) \subset B$
(e) $\alpha = A \times B$	

24) Let A = {a,b} and B={3,4}. The Cartesian Product, A x B is equal to

(a) {(a,3), (b,4)}.	(b) {(3,a), (4,b)}.	(c) {(a,3), (a,4),(b,3),(b,4)}.
(d) {(3,a), (3,b),(4,a),(4,b)}.	(e) {(a,b),(3,4)}.	

25) Let A be the set of all living people and β be the relation defined in A by $\beta=\{(a,b) \mid a \text{ is a parent of } b\}$.

Find β^{-1}.

(a) $\beta^{-1}=\{(a,b) \mid a \text{ is a father of } b\}$	(b) $\beta^{-1}=\{(a,b) \mid (a,b) \notin \beta\}$
(c) $\beta^{-1}=\{(a,b) \mid b \text{ is a parent of } a\}$	(d) $\beta^{-1}=\{(a,b) \mid b \text{ is a child of } a\}$
(e) $\beta^{-1}=\{(a,b) \mid a \text{ is a child of } b\}$	

26) Let A={4,6}, B={3,12,18} and $\beta=\{(x,y) \mid x\in A, y\in B, \text{ x divides y}\}$.

Which of the following is/are true?

(a) $\beta^{-1}=\{(3,4)\}$.
(b) $\beta^{-1}=\{(y,x) \mid (x,y) \in\beta\}$.
(c) $\beta^{-1}=\{(12,4),(12,6),(18,6)\}$.
(d) $\beta^{-1}=\{(4,12),(4,18),(6,12),(6,18)\}$.
(e) $\beta^{-1}=\{(x,y) \mid x\in B, y\in A, \text{ y divides x}\}$.

27) Let α and ρ be two relations given by
$\alpha=\{(5,6),(7,9),(8,3),(4,4)\}$ and $\rho=\{(6,1),(9,9),(8,5),(6,12),(10,4)\}$.

Then $\rho \mathbf{o} \alpha$ equals

(a) {(5,1),(5,12),(7,9)}
(b) {(8,6),(10,4)}
(c) {(5,6),(7,9),(8,3),(4,4),(6,1),(9,9),(8,5),(6,12),(10,4)}
(d) {(5,1),(5,12)}
(e) {(8,6)}

28) Consider the following three relations defined on Z.

$\beta=\{(x,y)|\ x\in Z,\ y\in Z,\ x = y\}$

$\alpha=\{(x,y)|\ x\in Z,\ y\in Z,\ x \le y\}$

$\rho=\{(x,y)|\ x\in Z,\ y\in Z,\ x > y\}$

Which of the following is/are true?

(a) β - symmetric, α - symmetric, ρ - transitive
(b) β - reflexive, α - symmetric, ρ - transitive
(c) β - reflexive, α - transitive, ρ - transitive
(d) β - symmetric, α - symmetric, ρ - symmetric
(e) $\beta= \alpha \cap \rho$

29) Let ρ be defined on A={1,2,3} by

$\rho=\{(1,1),(2,2),(3,3),(1,2),(2,1),(2,3),(3,2),(1,3),(3,1)\}$

Find $[1]_{\rho}$.

(a) $[1]_\rho =\{2,3\}$.
(b) $[1]_\rho =A$.
(c) $[1]_\rho =\{2\}$.
(d) $[1]_\rho=\{3\}$.
(e) $[1]_\rho =\{1\}$.

30) Suppose ρ is a relation. Which of the following is(are) true?

(a) $D(\rho)=\{ y \mid \exists x\ (x,y)\in \rho\}$, $R(\rho)=\{ x \mid \exists y\ (x,y)\in \rho\}$.
(b) $D(\rho^{-1})=\{ y \mid \exists x\ (x,y)\in \rho\}$, $R(\rho^{-1})=\{ x \mid \exists y\ (x,y)\in \rho\}$.
(c) $D(\rho)=\{ x \mid \exists y\ (x,y)\in \rho\}$, $R(\rho)=\{ y \mid \exists x\ (x,y)\in \rho\}$.
(d) $D(\rho^{-1})=\{ x \mid \exists y\ (x,y)\in \rho\}$, $R(\rho^{-1})=\{ y \mid \exists x\ (x,y)\in \rho\}$.
(e) $D(\rho\,\mathbf{o}\,\rho)=R(\rho)$.

31) Which of the following relations is/are **not** (a) function/s?

(a) $\alpha_1=\{(x,y)|\ x\in Z,\ y\in Z,\ x = y\}$
(b) $\alpha_4=\{(x,y)|\ x\in Z,\ y\in Z,\ y=2x + 1\}$
(c) $\alpha_2=\{(x,y)|\ x\in Z,\ y\in Z,\ x^2 = y^2\}$
(d) $\alpha_5=\{(x,y)|\ x\in Z,\ y\in Z,\ x < y\}$
(e) $\alpha_3=\{(x,y)|\ x\in Z,\ y\in Z,\ x \ge y\}$

32) Let function $f: R \longrightarrow R$ be defined by $f(x) = 5x – 3$. Find f^{-1}.

(a) $D(f^{-1})=R$, $f^{-1}(x) = 5x + 3$
(b) $D(f^{-1})=R$, $f^{-1}(x) = \frac{1}{5}x + 3$
(c) $D(f^{-1})=R$, $f^{-1}(x) = \frac{1}{5}(x + 3)$
(d) $D(f^{-1})=R$, $f^{-1}(x) = \frac{1}{3}(x + 5)$
(e) $D(f^{-1})=R$, $f^{-1}(x) = \frac{1}{5}(x - 3)$

33) Let the functions f and g be defined by $f(x) = 2x + 1$ and $g(x) = x^2 - 1$. Find the formula defining gof.

(a) $(2x+1)^2 - 1$	(b) $2(x^2 - 1) - 1$
(c) $2x^2 - 3$	(d) $4x(x+1)$
(e) $(x^2 - 1)(2x - 1)$	

34) Suppose A is a non-empty set and B = { f | f is bijection from A onto A }. Let f, $g \in$ B. Which of the following are/is true?

(a) $f\,o\,g \in$ B	(b) $f\,o\,g = g\,o\,f$	(c) R(f) $\subset$ B
(d) $f\,o\,f^{-1} \in$ B	(e) $f^{-1} \in$ B.	

35) How many words can be made from the letters of the word SUNDAY such that all vowels in it are together?

(a) 120.	(b) 240.	(c) 5**!**
(d) 6**!**	(e) (6**!**)/(2**!**)	

36) In how many ways can a class of 10 students be divided into two groups with six and four students?

(a) ${}^{10}C_6$.	(b) ${}^{10}P_6$.	(c) ${}^{10}C_4$.
(d) ${}^{10}P_4$.	(e) 105.	

37) Let <B, +, *, ′, 0, U > be a Boolean algebra, where B is a set, + and * are the sum and the product operators respectively and 0 and U the zero and the unit element respectively, and ′ the compliment operator.
Suppose a,b,c $\in$ B.

Which of the following are/is true?

(a) $a + (b * c) = (a + b) * (a + c)$	(b) $a * (b + c) = (a * b) + (a * c)$
(c) $a + 0 = 0$	(d) $a * 1 = 1$
(e) $a + a' = 1$	

38) A teacher gave three true(T) false(F) questions to her class. If students are not allowed to

(a) {1, 2, 3}.
(b) {0, 1, 2, 3}.
(c) {FFF, FFT, FTF, FTT, TFF, TFT, TTF, TTT}.
(d) { FFT, FTF, FTT, TFF, TFT, TTF, TTT }.
(e) {F, T}.

leave a question unanswered what is the sample space of the total number of correct answers.

39) Which of the following statements is/are correct?

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

40) If A and B are two events, then

(a) $P(A \cap \bar{B}) = P(B) - P(A \cup B)$.
(b) $P(A \cap \bar{B}) = P(\bar{B}) - P(A \cap B)$.
(c) $P(A \cap \bar{B}) = P(B) - P(A \cap B)$.
(d) $P(A \cap \bar{B}) = P(A) - P(A \cap B)$.
(e) $P(A \cap \bar{B}) = P(A) + P(\bar{B})$.

41) In an arrangement of five girls and two boys in a raw, the probability that no two boys sit together is

(a) $\frac{1}{21}$. (b) $\frac{2}{7}$. (c) $\frac{4}{7}$.
(d) $\frac{5}{7}$. (e) $\frac{6}{7}$.

42) A box has 5 black and 3 green marbles and a second box has 3 black and 5 green marbles. One marble is picked randomly from the first box and put in the second box. Now a marble is picked from the second box. What is the probability of it being a black one?

(a) $\frac{4}{9}$. (b) $\frac{29}{72}$. (c) $\frac{8}{72}$.
(d) $\frac{3}{16}$. (e) $\frac{7}{9}$.

43) In a certain university, 10% of the students are science majors, 10% are engineering majors and 80% are humanities majors. Of the science, engineering and humanities majors, 20%, 10% and 20% respectively have read University monthly magazine. Given that a student selected at random has read the magazine, what is the probability that the student is an engineering major?

(a) $\frac{10}{19}$. (b) $\frac{9}{19}$. (c) $\frac{5}{19}$.
(d) $\frac{2}{19}$. (e) $\frac{1}{19}$.

****