UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)
Academic Year 2008 /2009 – 2nd Year Examination – Semester 3

IT3303: Mathematics for Computing-II

PART I – Multiple Choice Question Paper
20th March 2009
(ONE HOUR)

Important Instructions :

- The duration of the paper is 1(one) hour.
- The medium of instruction and questions is English.
- The paper has questions 22 and 5 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 (*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.

1) If A is an $m \times n$ matrix and B is a $p \times q$ matrix, then which of the following is(are) always true?

(a)	(A + B) = (B + A) only if $n = p$
(b)	(A + B) = (B + A) only if $m = p$ and $n = q$
(c)	AB = BA only if $m = n = p = q$
(d)	AB = BA only if $n = p$ and $m = q$
(e)	AB = BA only if $m = n = p = q = 1$

2) If A is an $m \times n$ matrix and B and C are both $n \times m$ matrices, then which of the following is(are) always true?

(a)	$(\mathbf{A}(\mathbf{B}+\mathbf{C}))^{\mathbf{T}} = \mathbf{A}^{\mathbf{T}}(\mathbf{B}+\mathbf{C})^{\mathbf{T}}$	(b)	$(\mathbf{A}(\mathbf{B}+\mathbf{C}))^{\mathbf{T}} = (\mathbf{B}+\mathbf{C})^{\mathbf{T}}\mathbf{A}^{\mathbf{T}}$
(c)	$(\mathbf{A}(\mathbf{B}+\mathbf{C}))^{\mathbf{T}} = \mathbf{A}^{\mathbf{T}}(\mathbf{B}^{\mathbf{T}}+\mathbf{C}^{\mathbf{T}})$	(d)	$(\mathbf{A}(\mathbf{B}+\mathbf{C}))^{\mathbf{T}} = (\mathbf{C}^{\mathbf{T}}+\mathbf{B}^{\mathbf{T}})\mathbf{A}^{\mathbf{T}}$
(e)	$(\mathbf{A}(\mathbf{B}+\mathbf{C}))^{\mathbf{T}} = (\mathbf{B}^{\mathbf{T}}+\mathbf{C}^{\mathbf{T}})\mathbf{A}^{\mathbf{T}}$		

3) Let $A = \begin{pmatrix} 1 & -4 & 2 & -2 \\ 4 & 7 & -3 & 5 \\ 3 & 0 & 8 & 0 \\ -5 & -1 & 6 & 9 \end{pmatrix}$. If |A|=2042, then the determinant of the matrix $\begin{pmatrix} 1 & -4 & 2 & -2 \\ -5 & -1 & 6 & 9 \\ 4 & 7 & -3 & 5 \\ 3 & 0 & 8 & 0 \end{pmatrix}$ is

(a)	0	(b)	-2042	(c)	2042
(d)	1021	(e)	510.5		

4) Consider the following system of ***m*** linear equations in ***n*** unknowns.

$$a_{11}x_1 + a_{12}x_2 + \ldots\ldots + a_{1n}x_n = y_1$$
$$a_{21}x_1 + a_{22}x_2 + \ldots\ldots + a_{2n}x_n = y_2$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$a_{m1}x_1 + a_{m2}x_2 + \ldots\ldots + a_{mn}x_n = y_m$$

where $y_1, y_2, \ldots\ldots y_m$ and a_{ij} $1 \le i \le m$, $1 \le j \le n$ are real numbers and $x_1, x_2, \ldots\ldots x_n$ are n unknowns.

If the above system of linear equations is homogeneous, which of the following is(are) always true about the system?

(a)	The system is consistent	(b)	$y_1 = y_2 = \ldots.. = y_m = 0$
(c)	The system is inconsistent	(d)	The system has infinitely many solutions
(e) The system has a solution $x_1 = x_2 = \ldots\ldots. = x_n = 0$			

5) Let A be a square matrix of order n. Then A is non-singular if

(a) $A = A^T$	(b) A is orthogonal	(c) A^{-1} does not exist
(d) $\|A\| = 0$	(e) $\|A\| \neq 0$	

6) If $-\frac{2}{n} < x_n < -\frac{1}{n}$ for all $n \in N$, then the series $\sum_{n=1}^{\infty} x_n$

(a) converges to 0	(b) converges to -1	(c) converges to 1
(δ) diverges to ∞	(ε) diverges to - ∞	

7) If $y_n = 2y_{n-1} + 5$ for $n \in N$ and $y_0 = 3$, then y_{100} equals

(a) $2^{100} - 5$	(b) $3(2^{100}) + 5$	(c) $2^{101} - 5$
(d) $2^{103} - 5$	(e) $2^{100} + 5$	

8) The probability distribution of a discrete random variable X is given by

$$P(X = k) = \begin{cases} \frac{1}{k(k+1)}, & k = 1, 2, ...99 \\ a & k = 100 \\ 0 & \text{otherwise} \end{cases}$$

Then the value of a equals

(a) $\frac{1}{99}$	(b) $\frac{1}{100}$	(c) $\frac{1}{50}$
(d) $\frac{1}{1000}$	(e) $\frac{1}{500}$	

9) If $|a_n| < \frac{1}{n}$ for all $n \in N$, then $\sum_{n=1}^{\infty} \frac{1}{n^2 + a_n}$ is

(a) divergent
(b) conditionally convergent
(c) absolutely convergent
(c) convergent only if $a_n < 0$ for all $n >$ some n_0
(e) convergent only if $a_n > 0$ for all $n >$ some n_0

10) If $\frac{1}{1-x} = 1 + x + x^2 + x^3 + ...$, $|x| < 1$, then the expansion of $\left(\frac{1}{1-x}\right)^2$ equals

(a) $1 + 2x + 3x^2 + 4x^3 + ...$	$|x| < 1$	(b) $1 + x^2 + x^4 + x^6 + ...$	$|x| < 1$
(c) $1 - 2x + 3x^2 - 4x^3 + ...$	$|x| < 1$	(d) $1 - x^2 + x^4 - x^6 + ...$	$|x| < 1$
(e) $1 + 2x + 4x^2 + 8x^3 + ...$	$|x| < 1$		

11) If $\underline{a} = \underline{i} - 2\underline{j}$, $\underline{b} = \underline{j} - 2\underline{k}$ and $\underline{c} = \underline{k} - 2\underline{i}$, then the magnitude of $\underline{a} - 2\underline{b} + 3\underline{c}$ equals

(a) $6\sqrt{5}$	(b) $3\sqrt{5}$	(c) $3\sqrt{15}$

(d) $3\sqrt{10}$	(e) $5\sqrt{10}$	

12) If $\underline{a} = \underline{i} + \underline{j}$, $\underline{b} = \underline{j} + \underline{k}$ and $\underline{c} = \underline{k} + \underline{i}$, then $\underline{a} \times (\underline{b} \times \underline{c})$ equals

(a) $-\underline{i} + \underline{j}$	*(b)* $\underline{i} + \underline{j}$	*(c)* $-\underline{j} + \underline{k}$
(d) $\underline{j} + \underline{k}$	*(e)* $\underline{i} - \underline{j}$	

13) If $\underline{a} \, . \, \underline{b} \times \underline{c} = k\left[\frac{1}{2}\underline{c} \times \frac{1}{2}\underline{b} \cdot \frac{1}{2}\underline{a}\right]$ for all $\underline{a}$, $\underline{b}$ and $\underline{c}$, then k takes the value

(a) 1	(b) 8	(c) -8
(d) 4	(e) -4	

14) If $\underline{a} = \underline{i} + \underline{j} + \underline{k}$, $\underline{b} = \underline{i} - \underline{j} - \underline{k}$ and $\underline{c} = \underline{i} + \underline{j} + \alpha\,\underline{k}$, then $\underline{a} \,.\, \underline{b} \times \underline{c} = 0$ for

(α) any real number α	(β) any non-zero real number α
(c) $\alpha = 0$	(d) $\alpha = -1$
(e) $\alpha = 1$	

15) The derivative of $\mathbf{f}(\mathbf{x}) = \mathbf{x}^{\mathbf{x}^2}$ equals

(a) $\mathbf{x}^{\mathbf{x}^2+1}(1 + 2\ln \mathbf{x})$	(b) $\mathbf{x}^2 . \mathbf{x}^{\mathbf{x}^2 - 1}$	(c) $\mathbf{x}^{\mathbf{x}^2}(1 + 2\ln \mathbf{x})$
(d) $\mathbf{x}^{\mathbf{x}^2+1}$	(e) $\mathbf{x}^{\mathbf{x}^2-1} . 2\mathbf{x}$	

16) The value of $\int_{-L}^{+L} \cos(mx)\sin(nx)\,dx$ for $L > 0$ and $m, n \in N$ equals

(a) $\dfrac{\sin(mL)}{2m}$	(b) $\dfrac{\cos(mL)}{2m}$	(c) $\sin\left(\dfrac{mL}{\pi}\right)$
(d) 0	(e) 1	

17) Given that $\dfrac{d}{dt}\int_a^t f(x)dx = f(t)$ for constant a, $\dfrac{d}{dt}\int_3^{2t+1} x^2\,dx$ equals

(a) $4t^2 + 4t + 1$	(b) $8t^2 + 8t + 2$	(c) $8t^2 + 4t + 1$
(d) $8t^2 + 2$	(e) $4t^2 + 2$	

18) An ordinary die is thrown seven times. What is the probability of obtaining exactly three sixes?

(a) $\dfrac{3}{7}$	(b) $\left(3 \times \dfrac{1}{6}\right) + \left(4 \times \dfrac{5}{6}\right)$
(c) $\left(\dfrac{1}{6}\right)^3\left(\dfrac{5}{6}\right)^4$	(d) ${}^7C_3\left(\dfrac{1}{6}\right)^3\left(\dfrac{5}{6}\right)^4$

(e) $\quad {}^{7}C_{3}\left(\frac{1}{6}\right)^{4}\left(\frac{5}{6}\right)^{3}$

19) During peak time, breakdowns occur in a particular server at an average of two per hour. What is the probability that exactly 5 breakdowns occur per two hour period?

(a) $\frac{e^{-2}2^{5}}{5!}$ (b) $\frac{e^{-2}2^{5}}{5!}\times\frac{5}{2}$ (c) $5\times\frac{e^{-2}2^{5}}{5!}$

(d) $\frac{e^{-4}4^{5}}{5!}$ (e) $\frac{5}{2}\times\frac{e^{-4}4^{5}}{5!}$

20) Which one of the following does not represent a probability function?

(a) $P[X=x]=\frac{(x-2)}{5}$ for $x=1,2,3,4,5$

(b) $P[X=x]=\frac{(3x+1)}{22}$ for $x=0,1,2,3$

(c) $P[X=x]=\frac{1}{5}$ for $x=0,1,2,3,4,5$

(d) $P[X=x]=\frac{x}{5}$ for $x=1,2,3,4,5$

(e) $P[X=x]=\frac{x^{2}}{9}$ for $x=1,2,3$

21) Let X be a continuous random variable with probability density function $f(x)=e^{x}$, for $0<x<k$. The value of k equals

(a) $\ln 0.5$ (b) $\ln 1$ (c) $\ln 2$

(d) $\frac{2}{e}$ (e) $2e^{-1}$

22) Which of the following is/are NOT necessarily true for a continuous probability density function $f(x)$?

(a) $\int_{-\infty}^{\infty} f(x)\,dx=1$ (b) $\int_{0}^{\infty} f(x)\,dx=1$

(c) $f(x)\geq 0$ (d) $f(x)\leq 0$

(e) $P(a\leq X\leq b)=P(a<X<b)$

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