

Total No. of Questions - 05]

[Total No. of Printed Pages - 04

[4118] – 1

F. Y. B. Sc. (Computer Science) Examination, March – 2012

COMPUTER SCIENCE (PAPER - I)

(Introduction to Programming and 'C' Programming)

(June 2008 Pattern)

Time : Three Hours

Maximum Marks : 80

Note : (i) *All questions are compulsory.*

(ii) *Figures to the right indicate full marks.*

(iii) *Neat diagrams must be drawn wherever necessary.*

Q. 1. Answer **all** the following questions :

[10]

- (a) How the software is classified?
- (b) What is Assembly language? Give example.
- (c) What are Library functions in C?
- (d) What is escape sequence for Null character?
- (e) Give syntax and use of Typecast operator.
- (f) Which function is used to calculate square root of X in 'C' from Math.h Library? Give syntax.
- (g) 'Function can return multiple values'. Comment.
- (h) Give a macro definition
define SQUARE (X) (x)*(x)
What will be the output of following statement :
Printf ("%d", SQUARE (4 + 4));

- (i) Explain the use of file opening modes “a” and “at”.
- (j) Explain the difference between bitwise AND and logical AND operators with the help of examples.

Q.2. Answer the following questions (**Any Four**) :

[20]

- (a) Explain the basic data types in ‘C’.
- (b) What is the difference between the functions getch(), getchar(), getche()?
- (c) Give the difference between ‘while loop’ and ‘do while loop’ with example.
- (d) What is row major and column major representation of two dimensional array and state how address of any element is calculated in each, explain with suitable example.
- (e) What are command line arguments? How those are declared? What are the advantages of command line arguments.

Q.3. Answer the following questions (**Any Four**) :

[20]

- (a) Write an algorithm and draw a flowchart to find largest of n numbers.
- (b) What is the output of the following program?

```
main()
{
    char *P = “abcd”;
    printf(“%c”, *p++);
    printf(“%c\\”, *p);
}
```

- (c) Find and justify the output of the following program :

```
main()
{
    int a = 10, b =15;
    change (a, & b);
    printf ("%d%d", a,b);
}

change (int X , int *y)
{
    x = 20;
    *y = 30;
}
```

- (d) Write a program using recursive function to find factorial of given number.

- (e) Find and justify output of the following program :

```
main()
{
    int x [25];
    x [0] = 100;
    x [24] = 400;
    printf ("\n%d%d", *x, *(x+24) + *(x+ 0));
}
```

Q.4. Answer the following questions (Any Four) :

[20]

- (a) Write a program to check whether given number is Armstrong number or not.

- (b) Write a program to display the following pattern :

```
1  2  3  4
1  2  3
1  2
1
```

- (c) Write a program to find transpose of a matrix.
- (d) Write a program to copy one string to another without using standard library function. Use dynamic memory allocation to accept string.
- (e) Write a program to accept Item information (item no., item name, qty., price) for 'n' items. Store this in file and display it in well format. (Use of structure and fwrite () & fread () functions are expected).

Q.5. Answer the following questions (**Any Two**) :

[10]

- (a) Differentiate between pass by value and pass by reference.
- (b) Explain the following with syntax and example :
 - (i) Pointer as function argument.
 - (ii) Function returning pointer.
- (c) Explain the following :
 - (i) Union within structure union.
 - (ii) Nested macros.



Total No. of Questions - 05]

[Total No. of Printed Pages - 07

[4118] – 2

F. Y. B. Sc. (Computer Science) Examination, March – 2012

COMPUTER SCIENCE (PAPER - II)

(File Organization and Fundamentals of Databases)

(June 2008 Pattern)

Time : Three Hours

Maximum Marks : 80

Note : (i) *All questions are compulsory.*

(ii) *Figures to the right indicate full marks.*

(iii) *Neat diagrams must be drawn wherever necessary.*

(iv) *Assume suitable data, if necessary.*

Q.1. Answer **any Ten** of the following :

[10]

(a) Define - Logical File.

(b) In sequential file records are added as and when they are available. Comment.

(c) List the record based Logical Models.

(d) Which are two types of DMLs? Give examples.

(e) Define - Super Key.

(f) Explain one-to-one relationship with example.

(g) Give syntax and example of 'union' relational operator.

(h) Write a relational algebra query to select student with name = "RAM" from student (Roll no, Name, Marks, Grade)

(i) What is the difference between Char and Varchar.

- (j) List five built-in aggregate functions in SQL.
- (k) Give example of lossy decomposition.
- (l) Define - Transitive dependency.

Q.2. Answer the following. (**Any Four**) :

[20]

- (a) Write advantages and disadvantages of indexed file organization.
- (b) Differentiate indexed-sequential file and B + tree file organization.
- (c) Discuss different techniques of renormalization.
- (d) Discuss major components of E-R diagram.
- (e) Consider the following set of FDs.

{DM → NP, D → M, L → D, PQR → ST, PR → S}

Find canonical cover F_c .

Q.3. Answer the following. (**Any Four**) :

[20]

- (a) What are the desirable properties of decomposition?
- (b) What is attribute? Explain different types of attribute.
- (c) Normalize the following relation into 3 NF.

doctor - code hospital - no
doctor - name hospital - name
patient - name
patient - code
ward - no

- (d) Write short note on transaction control languages (TCL).
(e) Consider the following relations :

food-product (food-id, food-name, weight)

ingredients (in-id, name, quantity)

f-Ing (food-id, in-id, Qty)

Write the following in relational algebra :

- (i) List the names of ingredients along with their quantity, used in the product “Choco-cake”.
- (ii) List the names of ingredients used either in “Choco-Cake” or in “Choco-Icecream”.
- (iii) List the names of ingredients used in “Coconut-Burfi” or in “Boondi-Laddu”.
- (iv) List the names of food products, of the weight more than 2 kg.
- (v) List the names of ingredients not used in any food product.

Q.4. Answer the following (**Any Four**) :

[20]

- (a) Consider the following database :

Person (ss-no, name, address)

Car (lic, year, model)

Accident (date, driver, damage-amount)

Owns (ss-no, lic)

Log (lic, date, driver)

Write SQL statements for the following :

- (i) Find total no. of people whose cars were involved in accidents in 2000.
 - (ii) Find the no. of accidents in which the car belonging to 'Sachine' was involved.
 - (iii) Add a new person to the database.
- (b) Consider the following relation.

Employee (empno, empname, salary, comm., desg) :

Department (deptno, deptname, location)

Employee and Department are related with many to one relationship.

Solve the following queries :

- (i) Find out employees who are working at Pune location.
 - (ii) Find the maximum, minimum and average salary for every designation.
 - (iii) Update commission for every employee by 5% who belong to 'Computer department'.
- (c) Consider the following entities and relationships
- Owner (licence_no, name, address, phone)
- Car (carno, model, colour)
- Owner and Car are related with one-to-many relationships.

Create a RDB for the above and solve following queries :

- (i) Find the names of the owners of 'Zen' and 'Indica' cars.
- (ii) Insert a record in a car relation.
- (iii) To list the information of all cars in "Pune".
- (iv) List all the models of owner "Mr. Shah" having colour 'blue'.
- (v) Delete all the records of owner relation.

(d) Consider the following relation :

Person (pnumber, pname, birthdate, income)

Area (aname, area_type)

An area can have one or more persons living in it, but person belongs to exactly one area.

An attribute 'area_type' can have values either urban or rural.

Convert database in 3 NF and solve the following queries :

- (i) List the names of all people living in 'rural' area.
- (ii) List details of all people whose names start with the alphabet 'A' and contain maximum '6' alphabets in them.
- (iii) Give the count of people whose income is below 30,000.
- (iv) List the names of all people whose birthday falls in the month of January.
- (v) List names of all people whose income is between 50,000 to 75,000.

(e) Consider the following relation :

Machine (m_no, m_name, m_type, m_cost)

Part (p_no, p_name, p_desc)

Machine and Part are related with one to many relationships.

Create RDB and solve the following queries :

- (i) Increase the cost of machine by 10%.
- (ii) Delete all machines having particulars "Wheel".
- (iii) List all machines whose cost > 1,00,000.

Q.5. (A) Consider the following case study :

[7]

A movie studio wants to develop a database to manage their office information, related to movies, actors, directors, producers.

- (i) Each actor has acted in one or more movies.
- (ii) Each director has directed many movies.
- (iii) Each producer has produced many movies.
- (iv) Each movie is directed by one and only one director, but can be produced by more than one producers.
- (v) Each movie has one or more actors acting in it, in different roles.
- (vi) Each actor and director has several addresses. Each address is made up of house-no, street, city, state.

Total No. of Questions - 05]

[Total No. of Printed Pages - 07

(vii) Draw an E-R diagram.

(viii) Convert the E-R diagram to relational database in 3 NF.

(B) Write a short note on multivalued dependency.

[3]

Or

(B) Explain how insertions are done in ISAM.



[4118] – 3

F. Y. B. Sc. (Computer Science) Examination, March – 2012

MATHEMATICS (PAPER - I)

(Discrete Mathematics)

Time : Three Hours

Maximum Marks : 80

Note : (i) All questions are compulsory.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

Q. 1. Attempt all of the following question :

[8×2=16]

(i) Consider the recurrence relation

$$a_n = a_{n-1} + 2a_{n-2}; \text{ with } a_9 = 3 \text{ and } a_{10} = 5.$$

Find a_7 and a_{12} .

(ii) Define : (α) Big – O notation, (β) Big – Ω notation.

(iii) Find the number of ways to arrange the six letters in the word

‘FOLLOW’.

(iv) Write the negation of the following statements :

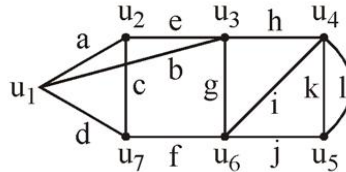
(α) All roses in the garden are either pink or white.

(β) For some real numbers x and y , $x^2 - y^4$ is negative.

(v) Write definitions of :

(α) Bipartite graph, (β) Flow in a network.

For questions (vi), (vii) and (viii), consider the following graph :



- (vi) Find eccentricities of the vertices u_7 and u_3 .
- (vii) List two paths between u_2 and u_5 of length 5.
- (viii) Find any two cutsets in the given graph.

Q. 2. Attempt any **Four** of the following :

[4×4=16]

- (i) Prove that $5^n - 1$ is divisible by 4, for $n \geq 1$.
- (ii) The students in a hostel were asked whether they had a TV set or a computer in their rooms. The result showed that 650 students had a TV set; 150 student did not have a TV set, 175 students had a computer and 50 student had neither a TV set nor a computer. Find the number of students who
 - (α) live in the hostel.
 - (β) have both a TV set and a computer.
 - (ϑ) have only a computer.
- (iii) Test the validity of the argument :

$$\sim p \wedge q, r \rightarrow p, \sim r \rightarrow s, s \rightarrow t \mid \vdash t$$
- (iv) Find particular solution of the recurrence relation

$$a_n - 4a_{n-2} = 3n.$$

- (v) Use insertion sort to arrange the following array in ascending order :

9, 7, 5, 3, 1, 8, 5, 4, 10

- (vi) Show that if any 14 integers are selected from the set

$S = \{1, 2, 3, \dots, 25\}$,

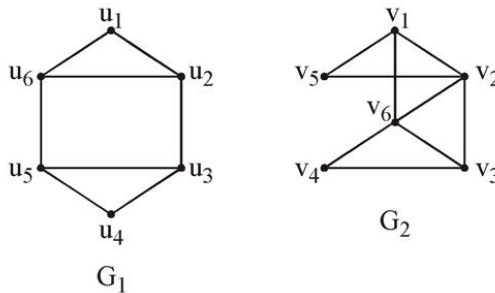
there are at least two integers whose sum is 26.

Q. 3. Attempt any **Four** of the following :

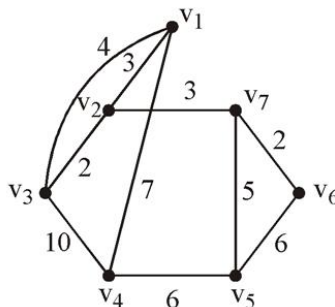
[4×4=16]

- (i) Prove that an edge 'c' of a connected graph G is an isthmus if and only if 'c' is not contained in any circuit of G.

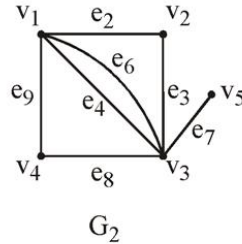
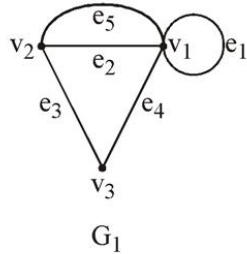
- (ii) Determine if the following graphs G_1 and G_2 are isomorphic. Justify your answer.



- (iii) Using Kruskal's algorithm, find minimum weighted spanning tree in the following graph :



(iv) Consider the graphs G_1 and G_2 :

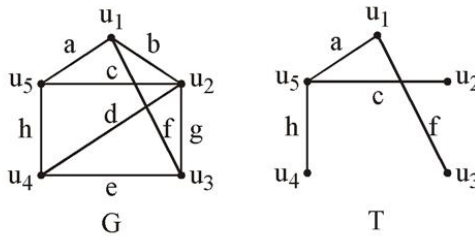


Find : $G_1 \cup G_2$ and $G_1 \cap G_2$.

(v) Draw the arborescence and write the following expression in Polish notation.

$$\frac{3x + y}{(6a - 3b)^7}$$

(vi) Consider the following graph G and its spanning tree T :



List all fundamental circuits in G with respect to T .

Q. 4. Attempt any **Two** of the following :

[2×8=16]

(i) (a) Test the validity of the following argument by using indirect proof.

$$p \vee q, p \rightarrow r, \sim r \vdash q$$

(b) List all possible functions from the set $A = \{a, b, c\}$ to the set $B = \{x, y\}$.

(ii) Give combinatorial argument to prove :

(a) binomial theorem

$$(b) \binom{n}{0}\binom{n}{1} + \binom{n}{1}\binom{n}{n-1} + \dots + \binom{n}{n}\binom{n}{0} = \binom{2n}{n}$$

(iii) Solve the recurrence relation

$$a_n - 2a_{n-1} = 3^n, \text{ where } a_1 = 1$$

(iv) Let $\{a_n\}$ be the sequence defined by the recursive relation

$$a_n = a_{n-1} + a_{n-2} + a_{n-3}; \text{ for } n \geq 3$$

with initial conditions $a_0 = a_1 = a_2 = 1$.

(a) Prove that all a_n are odd.

(b) Prove that $a_n \leq 2^{n-1}, n \geq 1$.

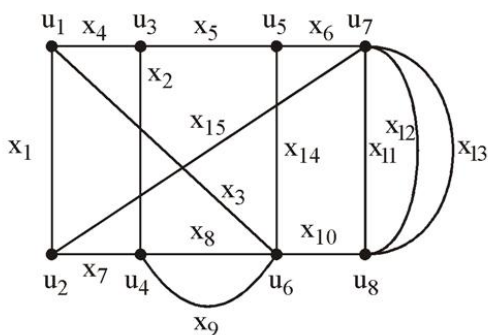
Q. 5. Attempt any **Two** of the following :

[2×8=16]

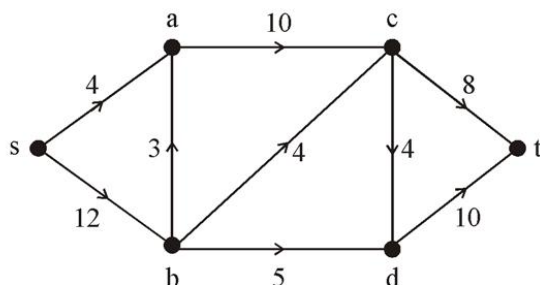
(i) (a) Draw the graph whose incidence matrix is given by

$$I = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

(b) Find the adjacency matrix of the following graph



(ii) Find the maximum flow in the following network by using Ford-Fulkerson Algorithm. Find the value of the maximum flow :



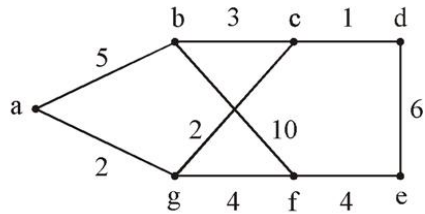
(iii) Let T be a graph on n vertices and with m edges. Then prove that following statements are equivalent.

- (a) T is a tree.
- (b) T has no circuits and $m = n - 1$.

Total No. of Questions - 05]

[Total No. of Printed Pages - 07

- (iv) Use Dijkstra's algorithm to obtain shortest path from a vertex 'a' to all the remaining vertices.



[4118] – 4

F. Y. B. Sc. (Computer Science) Examination, March – 2012

MATHEMATICS (PAPER - II)
(Algebra and Calculus)

Time : Three Hours

Maximum Marks : 80

- Note :** (i) All questions are compulsory.
(ii) Figures to the right indicate full marks.
(iii) Neat diagrams must be drawn, wherever necessary.

Q. 1. Attempt **all** of the following questions :

[8×2=16]

- (a) Let $f(x) = x^2 + 1$ and $g(x) = \frac{1}{x-1}$ then find $(f \circ g)(x)$.
- (b) Let $A = \{a, b\}$, $P(A)$ is power set of A . $R : P(A) \rightarrow P(A)$ is binary relation defined as $A R_B$ if and only if $A \subseteq B$.
Find diagram of R .
- (c) Check whether relation
 $R = \{(1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 3)\}$
is transitive on the $A = \{1, 2, 3\}$ or not. Justify.
- (d) Construct composition table for (Z_8^*, X_8) where (Z_8^*) is prime residue class set, in Z_8 .
- (e) Discuss the applicability of Lagrange's Mean Value theorem to the function
 $f(x) = x^{1/3}$, $x \in [-1, 1]$.
- (f) State whether the following sentence is true or false :
"Sum of two divergent sequences is divergent." Justify.

- (g) Discuss convergence of the series

$$\sum \left(\frac{8}{9}\right)^n.$$

- (h) Find 100th derivative of $(ax + b)^{100}$

Q. 2. Attempt any **Four** of the following :

[4×4=16]

- (a) Find remainder of $(1+2+3+\dots+100)^{100}$ after dividing by 7.

- (b) Z_{11} is set of residue classes mod 11. Then find the values of

(1) $(-\bar{2})^5$

(2) $(-\bar{3} +_{11} \bar{5})$

(3) $(-\bar{4}) +_{11} (-\bar{4})$

(4) $(\bar{8} +_{11} \bar{7})$

- (c) Let $[B, -, \vee, \wedge]$ be a Boolean algebra. Let $a, b \in B$, then prove that $\overline{a \wedge b} = \bar{a} \vee \bar{b}$.

- (d) For any $a, b, x \in Z$, show that $(a, b) = (a, b + ax)$.

- (e) Draw Hasse diagram of the poset D_{48} , the set of all divisors of 48 with respect to partial order relation “divides”.

- (f) Let $a, b, x \in \mathbb{Z}$. Prove that

(i) $a \in [b] \Leftrightarrow [a] = [b]$

(ii) $a \in [a]$

where $[a]$ and $[b]$ are equivalence classes of a and b respectively.

Q. 3. Attempt any **Four** of the following :

[4×4=16]

- (a) Verify Rolle’s Mean Value theorem for $f(x) = 2 + (x - 1)^{2/3}$, $x \in [0, 2]$.

(b) Show that the sequence $\langle a_n \rangle$

where $a_n = \frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \dots + \frac{1}{n(n+1)}$ is convergent and find its limit.

(c) Discuss the continuity of the function :

$$f(x) = \begin{cases} \frac{x^2 - 9}{x - 3} & \text{if } 0 \leq x < 3 \\ 4x - 6 & \text{if } 3 \leq x < 6 \\ 2x + 9 & \text{if } 6 \leq x < 9 \end{cases}$$

(d) Examine for convergence of series, $\sum_{n=1}^{\infty} \frac{n!}{n^n}$

(e) Derive the expression for n^{th} derivative of $e^{ax} \cos(bx + c)$.

(f) Evaluate : $\lim_{x \rightarrow 0} \frac{a}{x} - \cot\left(\frac{x}{a}\right)$.

Q. 4. Attempt any **Two** of the following :

[2×8=16]

(a) Find g.c.d. of 3587 and 1819. Express it in the form $3587m + 1819n$. Find values of m and n .

(b) Let $A = \{1, 2, 3, 4, 5\}$ and $R = \{(1, 1), (1, 4), (2, 2), (3, 4), (3, 5), (4, 1), (5, 2), (5, 5)\}$ be a relation on A . Find transitive closure of R . Also find diagraph of transitive closure of R .

(c) (i) For the Boolean expression

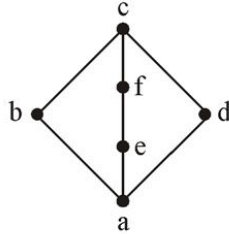
$$f(x_1, x_2, x_3) = (x_1 \vee x_2) \wedge x_3$$

Find disjunctive normal form of $f(x_1, x_2, x_3)$.

(ii) Find conjunctive normal form of the Boolean expression

$$E(x, y) = (x \vee \bar{y}) \vee (x \wedge \bar{y})$$

- (d) (i) Show that 19 is not divisor of $4n^2 + 4$, for any integer n .
 (ii) Determine if the following lattice is distributive lattice.
 Justify.



Q. 5. Attempt any **Two** of the following :

[2×8=16]

- (a) If $a < 1$, $b < 1$ and $b > a$ then prove that :

$$\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$$

- (b) If $y = e^{(\tan^{-1} x)}$ then show that

$$(1+x^2)y_{n+2} + [2(n+1)x-1]y_{n+1} + n(n+1)y_n = 0$$

- (c) (i) Expand $\log(\sin x)$ in ascending power of $(x-3)$.
 (iii) Prove that :

$$\sin^{-1}(x) = x + 1^2 \cdot \frac{x^3}{3!} + 1^2 \cdot 3^2 \cdot \frac{x^5}{5!} + 1^2 \cdot 3^2 \cdot 5^2 \cdot \frac{x^7}{7!} + \dots$$

- (d) State Cauchy's Mean Value theorem and verify for functions

$$f(x) = \frac{1}{x^2}, \quad g(x) = \frac{1}{x} \text{ in } [a, b], \quad a > 0.$$

Show that $a < c < b$, such c is in harmonic mean of a and b .



[4118] – 5

F. Y. B. Sc. (Computer Science) Examination, March – 2012

ELECTRONICS (PAPER - I)

(Electronic Devices, Circuits and Computer Peripherals)

(New 2008 Pattern)

Time : Three Hours

Maximum Marks : 80

Note : (i) *All questions are compulsory.*

(ii) *Use of non-programmable electronic calculator is allowed.*

(iii) *Draw neat diagrams wherever necessary.*

(iv) *Figures to the right indicate full marks.*

Q.1. Attempt **all** of the following questions :

[16]

(a) Draw the typical nature of forward and reverse characteristics of PN junction diode.

(b) Define alpha (α) and beta (β) of a BJT.

(c) State : (i) Thevenin's theorem, (ii) Norton's theorem.

(d) Draw the symbols for N-channel JFET and P-channel JFET.

(e) Draw the circuit diagram for Op-Amp as an integrator.

(f) State the conditions of Barkhausen criteria for sustained oscillations.

(g) State any two applications of SMPS.

(h) Mention any two disadvantages of LCD display.

Q.2. Attempt **any four** of the following :

[16]

(a) Explain working principle of dot-matrix printer.

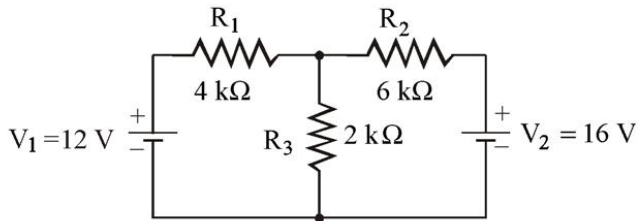
(b) Explain working of bridge rectifier with neat circuit diagram and waveforms.

- (c) Draw the circuit diagram for Op-Amp as a subtractor. Derive an expression for its output voltage.
- (d) Explain phase shift oscillator with proper circuit diagram.
- (e) Compare BJT and FET (any four points).
- (f) Explain working of reverse biased PN junction diode with proper circuit diagram.

Q.3. Attempt **any four** of the following :

[16]

- (a) Explain ‘virtual ground’ concept in case of Op-Amp.
- (b) Find the current flowing through resistor R_3 in the following circuit using superposition theorem.

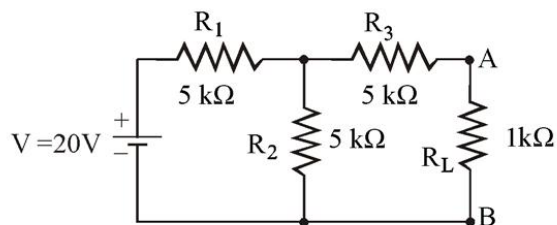


- (c) Draw and explain the block diagram of ON-line UPS.
- (d) Explain working of flat-bed scanner.
- (e) Give the ideal values of Op-Amp characteristics (any four).
- (f) Explain working principle of light emitting diode (LED) and state its any two applications.

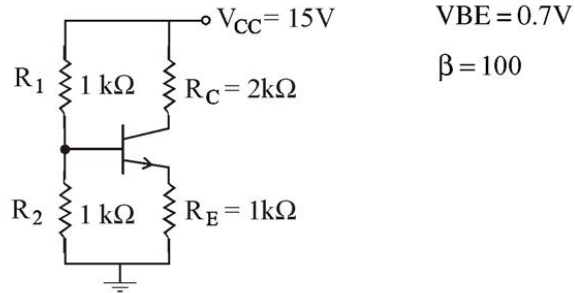
Q.4. Attempt **any two** of the following :

[16]

- (a) (i) Explain Hartley’s oscillator with neat circuit diagram.
- (ii) Draw Norton’s equivalent circuit for the following circuit:



- (b) (i) Explain JFET as a switch.
- (ii) Explain the classification of amplifiers based on operating point (Q-point).
- (c) (i) Draw the d.c. load line for the given circuit :

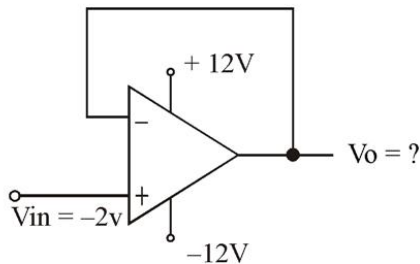


- (ii) Draw the circuit diagram for Op-Amp as an inverting amplifier and derive an expression for its output voltage.
- (d) (i) Explain BJT as an amplifier.
- (ii) State different parts of HDD. Explain any three of them in brief.

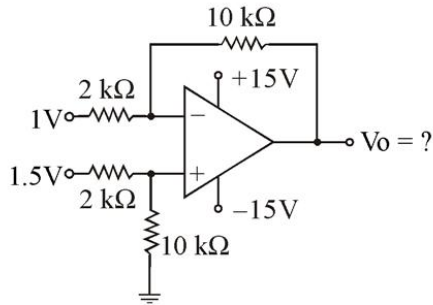
Q. 5. Attempt **any one** of the following :

[16]

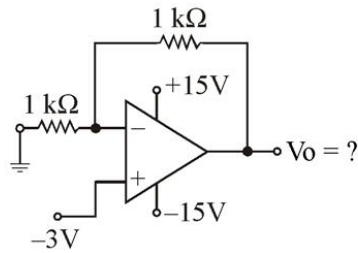
- (a) (i) Identify the following Op-Amp configurations and find their output voltages :



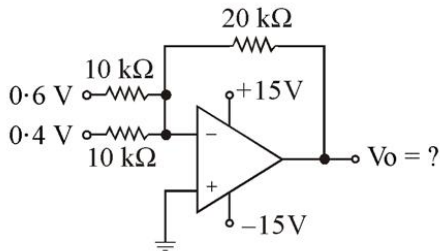
(A)



(B)



(C)



(D)

- (ii) Explain working principles of optical mouse and plasma display.
- (b) (i) Explain the working principles of spike suppressor and SMPS.
- (ii) (1) Compare CD-ROM and DVD-ROM (any four points).
- (2) Explain any four components of motherboard in brief.



Total No. of Questions - 05]

[Total No. of Printed Pages - 04

[4118] – 6

F. Y. B. Sc. (Computer Science) Examination, March – 2012

ELECTRONICS (PAPER - II)

(Fundamentals of Digital Electronics)

(New 2008 Pattern)

Time : Three Hours

Maximum Marks : 80

Note : (i) *All questions are compulsory.*

(ii) *Use of non-programmable electronic calculator is allowed.*

(iii) *Draw neat logic diagrams wherever necessary.*

Q. 1. Attempt **all** of the following questions :

[8×2=16]

- (a) What is a weighted number system? Give any example of such a system.
- (b) Which logic gates are known as universal gates? Draw their symbols.
- (c) Draw the logic diagram of half subtractor.
- (d) In which modes of operation can IC 7495 be used?
- (e) A monostable multivibrator using IC 555 generates 5 ms pulse. If a 40 k Ω external resistor is connected, find the value of timing capacitor.
- (f) Find the number of chips required to obtain 16 k \times 8 memory using 1 k \times 8 memory chips.

- (g) A flash ADC has resolution of 4 bits. If clock rate is 100 kHz, what is the conversion time?
- (h) Write the full form of SIMD and ARM.

Q.2. Attempt **any four** of the following :

[4×4=16]

- (a) Minimize the following logical function using K-maps.

$$y = \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D + \overline{A}B\overline{C}\overline{D} + A\overline{B}\overline{C}\overline{D} + A\overline{B}C\overline{D}$$

- (b) State and prove De'Morgan's theorems.
- (c) (i) $(27)_{10} = (?)_{\text{BCD}}$
 (ii) $(396)_{10} = (?)_{\text{Excess 3}}$
 (iii) $(1001)_2 = (?)_{\text{Gray}}$
 (iv) $(1001)_{\text{Gray}} = (?)_{\text{Binary}}$
- (d) Differentiate between an embedded computer and a general purpose computer.
- (e) Draw the logic diagram of JK flip flop using four NAND gates and explain its working.
- (f) Determine the frequency of oscillation and the duty cycle of an astable multivibrator using I C 555 given $R_A = R_B = 1\text{k}\Omega$ and $C = 1000\text{ pF}$.

Q.3. Attempt **any four** of the following :

[4×4=16]

- (a) Explain the block diagram of ALU.
- (b) Write the features of supercomputer and server.

- (c) Simplify the logic expression :

$Y = \overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C} + A\overline{B}\overline{C} + A\overline{B}C$ using the laws of Boolean algebra.

- (d) Perform the following subtraction using 2's complement method :

$$(110000)_2 - (10111)_2$$

- (e) Draw the circuit diagram of 4 bit R-2 R ladder DAC. Find the output voltage of 5 bit ladder with a digital input of 11010.

Assume that 0 = 0 V and 1 = +10 V.

- (f) Define the following terms related to memory devices

Volatile, Non-volatile, Speed and Capacity.

Q.4. Attempt **any two** of the following :

[2×8=16]

- (a) Draw the circuit of BCD-to-Decimal decoder. Explain its working. Write its truth table.

- (b) Draw and explain the logic circuit for 4 bit right shift serial in serial out shift register. Draw the timing diagram to shift the data 0100 into the shift register.

- (c) Perform the following :

(i) $(23.85)_{10} = (?)_2$

(ii) $(E8D6)_{16} = (?)_8$

(iii) $(-12)_{10} = (?)_2$

(iv) $(1111\ 1010)_2 + (1000\ 0111)_2 = (?)_2$

- (d) Draw the circuit diagram of two input TTL NAND gate. Explain its phase splitter stage.

Define the terms :

Propagation delay time and Noise margin of a logic family.

Q. 5. Attempt **any one** of the following :

[1×16=16]

- (a) (i) Draw and explain the block diagram of I C 555.
(ii) Give the classification of memory. Explain the working of diode matrix ROM.
- (b) (i) Draw and explain the logic diagram of a nibble adder. How many half adders and full adders will be required to add two 32 bit numbers?
(ii) Construct the following counters using I C 7490 :
MOD 3, MOD 5, MOD 6 and MOD 10.



Total No. of Questions - 05]

[Total No. of Printed Pages - 07

[4118] – 7

F. Y. B. Sc. (Computer Science) Examination, March – 2012

STATISTICS (PAPER - I)

(Statistical Methods - I)

(2008 Pattern)

Time : Three Hours

Maximum Marks : 80

- Note :** (i) *All questions are compulsory.*
(ii) *Figures to the right indicate full marks.*
(iii) *Use of single memory, non-programmable, scientific calculators and statistical tables is allowed.*
(iv) *Symbols have their usual meanings unless otherwise stated.*
-
-

Q.1. Attempt **all** of the following :

[8×2=16]

- (a) Define a weighted mean. Describe a situation, where weighted mean is preferred to unweighted mean.
- (b) Are the data $n = 10$, $\sum x^2 = 400$, $\bar{x} = 7$ consistent? Justify your answer.
- (c) The coefficient of correlation between two variables X and Y is 0.4. Their covariance is 12. If variance of X is 100, what is standard deviation of Y?
- (d) State whether the following statements are True or False :
- (i) The Bowley's coefficient of skewness is based on only the central 50% of the data.

[4118] – 7

Page 1

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Total No. of Questions - 05]

[Total No. of Printed Pages - 07

- (ii) If a frequency distribution have open end classes, histogram can not be drawn.
- (e) Define coefficient of determination.
- (f) The equations of the two lines of regression are $3x - y - 5 = 0$ and $4x - 3y = 0$. Find the arithmetic means of x and y.
- (g) State the components of Time Series.
- (h) Define process capability index (CP) and process performance index (CPK).

Q.2. Attempt **any four** of the following :

[4×4=16]

- (a) Explain the following terms with an illustration :
- (i) Relative frequency
- (ii) Less than cumulative frequency
- (b) Define Mode as a measure of central tendency. Also state any two merits and demerits of mode.
- (c) Represent the following data using histogram :

Age Group (in years)	0-20	20-40	40-60	60-80	80-100	100-120
Population	500	2100	2200	2000	1600	400

- (d) An incomplete frequency distribution is given below :

Marks	10-20	20-30	30-40	40-50	50-60	60-70
Students	12	30	?	65	?	43

The total frequency is 230 and the median of the data is 46.
Find the missing frequencies.

- (e) A group of 50 items have mean and standard deviation 61 and 8 respectively. Another group of 100 observations have mean and standard deviation 70 and 9 respectively. Find mean and standard deviation of the combined group.
- (f) If $n = 100$, $\Sigma X = -20$, $\Sigma X^2 = 220$, find standard deviation and coefficient of variation.

Q. 3. Attempt **any four** of the following :

[4×4=16]

- (a) Define raw and central moments for grouped data. Express fourth central moment in terms of raw moments.
- (b) Write a note on kurtosis.
- (c) Define Karl Pearson's coefficient of correlation. Explain the concept of positive correlation with an example.
- (d) Calculate μ_3 and μ_4 from the following data :

$$\beta_1 = 0.19, \beta_2 = 2.6 \text{ and } \mu_2 = 1.2$$

- (e) Calculate the rank correlation coefficient to measure the degree of relationship between tannin and nicotine content in teas :

Tea Brand	A	B	C	D	E	F	G	H	I	J
Tanning Content	14	17	28	19	16	13	24	25	18	31
Nicotine Content	0.9	1.1	1.6	1.3	1.0	0.8	1.5	1.4	1.2	2.0

- (f) For two distributions A and B the following summary statistics are available :

	Median	Q_1	Q_3	Min.	Max.
A	20	13	30	10	35
B	24	14	31	10	35

Compare the skewness of two distributions using box plot.

Q. 4. Attempt **any four** of the following :

[4×4=16]

- (a) For a bivariate data, $\bar{X} = 53$, $\bar{Y} = 28$, $b_{yx} = -1.5$,

$b_{xy} = -0.2$, find :

- (i) Correlation coefficient between X and Y.
 (ii) Estimate Y when X = 60
- (b) Explain the procedure of fitting a second degree curve

$y = a + bx + cx^2$ for a given bivariate data

$\{(x_i, y_i), i = 1, 2, \dots, n\}$.

- (c) Given the following information on a trivariate data :

$$\bar{X}_1 = 68 \quad \bar{X}_2 = 70 \quad \bar{X}_3 = 74$$

$$\sigma_1^2 = 100 \quad \sigma_2^2 = 25 \quad \sigma_3^2 = 81$$

$$r_{12} = 0.6 \quad r_{13} = 0.7 \quad r_{23} = 0.65$$

Obtain the equation of a multiple regression plane of X_3 on X_1 and X_2 .

- (d) Define time series with an illustration. Also explain cyclical variation in a time series.
- (e) If the total correlation coefficients in a set of 3 variables are equal to r ($r \neq 1$) then show that,

(i) $R^2_{1,23} = 2r^2 / (1 + r)$

(ii) $r_{12,3} = r / (1 + r)$

- (f) Below are given the means and ranges of 12 samples of size 5 each taken from a certain production process at regular intervals.

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12
Mean	23.2	25.7	24.9	24.3	25.1	22.9	26.1	27.9	24.7	22.8	22.6	28.5
Range	3.1	3.5	2.9	3.7	2.4	3.7	2.4	3.6	2.5	4.0	6.0	3.3

Assuming that the R chart is in control, draw \bar{X} chart and hence comment whether the process is under statistical control?
(for $n = 5$, $A_2 = 0.577$)

Q.5. Attempt **any four** of the following :

[4×4=16]

(a) Explain the concept of multiple and partial correlation for a trivariate data.

(b) Define :

(i) Regression coefficient of X on Y.

(ii) Regression coefficient of Y on X.

Also state any 'two' properties of the regression coefficients.

(c) A certain population has logistic growth with equation approximately

$$Y = \frac{60}{1 + e^{180 - 0.09x}}$$

Y = Population in lacs

X = Year

(i) Estimate the population in the year 2012.

(ii) Find the year when the population was half of the carrying capacity.

- (d) Calculate 5 yearly moving averages for the following data :

Year	1	2	3	4	5	6	7	8	9
Value	260	270	275	300	310	315	300	290	310

- (e) Describe the cause and effect diagram (Ishikawa diagram) as a process control tools.
- (f) Explain 'Ratio to Trend' method for calculating the seasonal variations in a time series data.



Total No. of Questions - 05]

[Total No. of Printed Pages - 07

[4118] – 8

F. Y. B. Sc. (Computer Science) Examination, March – 2012

STATISTICS (PAPER - II)

(Statistical Methods - II)

(2008 Pattern)

Time : Three Hours

Maximum Marks : 80

Note : (i) *All questions are compulsory.*

(ii) *Figures to the right indicate full marks.*

(iii) *Use of single memory, non-programmable, scientific calculators and statistical tables is allowed.*

(iv) *Symbols have their usual meanings unless otherwise stated.*

Q.1. Attempt the following questions :

[8×2=16]

(a) If A and B are mutually exclusive, state whether the following statements are True or False :

(i) $P(A \cup B) = 0$

(ii) $P(A \cup B) = P(A) + P(B)$

(b) A, B and C are three arbitrary events defined on a sample space Ω .

Find expressions for the following :

(i) At least two occur.

(ii) Exactly one of the three events occurs.

- (c) If A and B are any two events defined on Ω , such that $P(A) = 3/4$ and $P(B) = 5/8$ then show that $P(A \cup B) \geq 3/4$.
- (d) Suppose $X \rightarrow B(n, p)$.
Is it possible to have $E(X) = 3$ and $\text{Var}(X) = 5$?
- (e) The following is probability distribution of a discrete random variable X.

X	0	1	2	3
P(X = x)	0.1	0.3	0.5	0.1

Obtain probability distribution of $X^2 + 2X$.

- (f) State normal approximation to Poisson distribution.
- (g) Define Pareto distribution and state its mean.
- (h) State Box-Muller transformations.

Q. 2. Attempt **any four** of the following :

[4×4=16]

- (a) A bag contains 10 balls, 2 of which are red, 3 blue and 5 black. Three balls are drawn at random from the bag. What is the probability that :
- The three balls are of different colours.
 - Exactly two balls are of the same colour.
- (b) Define partition of the sample space. Also state Bayes' theorem.

- (c) (i) State the axioms of probability.
(ii) If $A \subset B$, then prove that $P(A) \leq P(B)$.
- (d) Computer chips often contain surface imperfections. For a certain type of computer chip, 9% contain no imperfection, 22% contain 1 imperfection, 26% contain 2 imperfections, 20% contain 3 imperfections, 12% contain 4 imperfections and the remaining 11% contain 5 imperfections. Let X represent the number of imperfections in a randomly chosen chip.
- (i) Find probability distribution of X.
(ii) Find average number of imperfections.
- (e) Define :
- (i) Conditional probability
(ii) Independent events
- (f) Let A and B be any two events defined on the sample space.
If $P(A) = 0.98$, $P(B) = 0.95$ and $P(A \cup B) = 0.99$ find :
- (i) $P(A \cap B)$
(ii) $P(A' \cap B)$

Q. 3. Attempt **any four** of the following :

[4×4=16]

- (a) Define each of the following for a discrete random variable X :
- (i) Median
(ii) Cumulative distribution function

- (b) If a discrete uniform random variable assuming values 1, 2, ..., n has mean 6, find $P(X > 8)$.
- (c) Define binomial distribution. Give one real life situation where binomial distribution is applied. State its additive property.
- (d) The number of cars crossing a bridge during a certain interval has approximately a Poisson distribution with mean 4. Find the probability that during a randomly chosen interval of time,
 - (i) no car will cross the bridge,
 - (ii) at least 3 cars will cross the bridge.
- (e) The number of hardware failures (X) of a computer system in a week of operation has the following probability mass function (p. m. f):

X	0	1	2	3	4	5	6
$P(X = x)$	0.18	0.28	0.25	0.18	0.06	0.04	0.01

Find : (i) $E(X)$, (ii) $V(X)$.

- (f) Define geometric distribution. State its mean and variance. Give one real life situation where geometric distribution is applied.

Q. 4. Attempt **any four** of the following :

[4×4=16]

- (a) The lifetime of a microprocessor is exponentially distributed with mean 3000 hours. Find the probability that,
 - (i) The microprocessors will fail within 300 hours.

- (ii) The microprocessors will function for more than 6000 hours.
- (b) State any 'four' properties of distribution function of a continuous random variable.
- (c) A projectile is fired at a target. The distance from the point of impact to the center of the target (in meters) is a r.v. (X) with probability density function (p. d. f),

$$f(x) = 6x(1-x) \quad 0 < x < 1$$
$$= 0 \text{ otherwise}$$

Find :

- (i) $P(X < 0.4)$
- (ii) Distribution function of X.
- (d) Define normal distribution. State any 'two' important properties of normal distribution.
- (e) If X is a normal random variable with mean 3 and variance 16, find :
- (i) $P(X < 11)$
- (ii) $P(2 < X < 7)$
- (f) In a random sample of 600 cars making a right turn at an intersection, 157 pulled into the wrong lane. Test the hypothesis that the actual proportion of drivers making this mistake is 0.30. Use 5% level of significance.

Q. 5. Attempt any four of the following :

[4×4=16]

- (a) Define the following terms :
- (i) Sample
 - (ii) Parameter
 - (iii) Sampling distribution of a statistic
 - (iv) Level of significance
- (b) A random sample of 90 adults is classified according to gender and the number of hours they watch television during a week :

	Gender	
	Male	Female
Over 25 hours	15	29
Under 25 hours	27	19

Use 0.01 level of significance and test the hypothesis that the time spent watching television is independent of whether the viewer is male or female.

- (c) Explain the procedure of testing $H_0 : P_1 = P_2$ against $H_1 : P_1 > P_2$ for a large sample at α % level of significance.
- (d) A company wants to send 20 employees selected randomly from the finance and marketing departments for advanced training. The company's administrative officer has selected random samples as below :

FFFFMMMMFFFFMMMMFFFF (Where M = male, F = female).

Test the randomness of the sample. Use 5% level of significance.

- (e) Good website design can make Web navigation easier. A sample of 10 users using a conventional Web design averaged 32.3 items identified, with a standard deviation of 8.56. A sample of 10 users using a new structured Web design averaged 44.1 items identified, with a standard deviation of 10.09. Test whether the mean number of items identified is equal with both the designs. Use 5% level of significance.
- (f) Explain the method of drawing a model sample from an exponential distribution with mean θ .

