

Total No. of Questions : 5]

[Total No. of Printed Pages : 4

[3918]-1

F. Y. B. Sc. (Computer Science) Examination - 2011

COMPUTER SCIENCE

PAPER - I

INTRODUCTION TO PROGRAMMING AND 'C' PROGRAMMING

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) All questions are compulsory.*
 - (2) Figures to the right indicate full marks.*
 - (3) Neat diagrams must be drawn wherever necessary.*
-
-

Q.1) Answer the following : (Any Ten)

[1x10=10]

- (1) What is Null Statement ?
- (2) Define a Variable.
- (3) What is Preprocessor ?
- (4) What is the use of gets() and puts() functions ?
- (5) What do you mean by Exit Controlled Loop ?
- (6) Find memory required for :

union stud

{

 char name[20];

 long int reg_id;

}

- (7) What is Void Pointer ?
- (8) What do you mean by Library Functions ?

- (9) 'C' performs bound checking for an array. State whether true or false and justify.
- (10) Give syntax of fseek() function.
- (11) What do you mean by Bitwise Operator ?
- (12) What is the significance of argv[0] ?

Q.2) Answer the following : (Any Four) [5x4=20]

- (a) Explain various modes which are used in fopen() function, with suitable examples.
- (b) Differentiate between Structure and Union.
- (c) Explain Concept of Conditional Compilation, also list various preprocessor directives used for the same.
- (d) What is Dynamic Memory Allocation ? Explain various functions used for the same with their syntax.
- (e) Explain Concept of Enumeration in 'C', with an example.

Q.3) Answer the following : (Any Four) [5x4=20]

- (a) Define an Algorithm and explain various properties of the Algorithm.
- (b) What would be printed from the following program block ?

```
main( )
{
    char *a[5] = {"GOOD", "BAD", "UGLY", "WICKED",
                 "NICE"};
    printf("%S\n", a[0]);
    printf("%S\n", * (a + 2));
    printf("%C\n", * (a[2] + 2));
    printf("%S\n", * a[3]);
    printf("%C\n", * (a[3] + 2));
}
```

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

```
main()
{
    int i;
    i = 10;
    printf(“%d %d %d %d %d”, i++, ++i, --i, i--, ++i);
}
```

- (d) Write a recursive function for finding x^y .

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

```
main( )
{
    int x = 9876;
    printf(“%d\n”, x);
    printf(“%6d\n”, x);
    printf(“%2d\n”, x);
    printf(“%-6d”, x);
    printf(“\n%06d”, x);
}
```

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

[5x4=20]

- (a) Write a 'C' program to store 2 sets of integers as an array and find intersection of two sets.
- (b) Write a program to accept 3 numbers as command line argument and check whether the first is between the other two numbers. eg. if arguments are 20 10 30, then output - 20 is between 10 and 30.
- (c) Write a 'C' program that accepts n words and displays them in dictionary order.
- (d) Write a 'C' program for creating a structure employee with eno, ename and salary. Accept details of n employees and display records in descending order of salary.
- (e) Write a program in 'C', which will accept a string and copies it into another string such that only alternate characters are copied. (Use Pointers)
eg. if S1 = "Hello World",
then S2 = "HloWrD".

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

[5x2=10]

- (a) Differentiate between Compiler and Interpreter.
 - (b) Explain Concept of Formal and Actual Parameters with suitable example.
 - (c) Write difference between Macro and Function.
-

Total No. of Questions : 5]

[Total No. of Printed Pages : 4

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F. Y. B. Sc. (Computer Science) Examination - 2011

COMPUTER SCIENCE

PAPER - II

FILE ORGANISATION AND FUNDAMENTALS OF DATABASES

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
- (2) *Figures to the right indicate full marks.*
- (3) *Neat diagrams must be drawn wherever necessary.*

Q.1) Answer the following : (Any Ten)

[1x10=10]

- (1) Define Second Normal Form.
- (2) What do you mean by Derived Attribute ?
- (3) What do you mean by Natural Join Operation ?
- (4) Distinguish between Where and Having Clause.
- (5) What is Query Optimization ?
- (6) Define Prime Attribute.
- (7) What is Hashing ?
- (8) Define Primary Index.
- (9) What do you mean by Referential Integrity Constraint ?
- (10) Define Database System.
- (11) Define any two types of File Organisation.
- (12) Define Weak Entity.

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

[5x4=20]

- (a) Explain B⁺ Tree Insertion Algorithm.
- (b) Define DBMS. What are the advantages and limitations of DBMS ?
- (c) Explain Aggregation and its applications.
- (d) What is Referential Constraint ? Explain in brief.
- (e) Consider relations :

R(A, B, C, D, G, H, I) and Set of FDs defined on F as

{A → B, A → C, CG → H, CG → I, B → H}

Compute closure of f i.e. F⁺.

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

[5x4=20]

- (a) Write any four functions of DBA.
- (b) Explain and distinguish among the terms Primary Key, Candidate Key and Superkey.
- (c) What are the undesirable properties of a Bad Database Design ?
- (d) State and explain in short rules of inference for functional dependencies.
- (e) Explain Overall DBMS Structure with neat diagram.

Q.4) (A) Answer the following : (Any Three)

[5x3=15]

- (a) Consider the following relations :

Country(Con-code, Name, Capital)

Population(Pop-code, Population)

Country and Population are related with one to one relationship. Create RDB and solve the following queries :

- (i) List highest population country.
- (ii) Give name and population of country whose capital is 'Tokyo'.
- (iii) List names of all countries whose population is greater than 50,00,000.

- (b) Consider the following relations :
- Game(Gno, Gname, No. of Player, Coachname, Captain)
Player(Pno, Pname)
- Game and Player are related with many to many relationship.
Create a RDB and solve the following queries :
- (i) List names of players playing cricket and hockey.
 - (ii) Count no. of players whose coach name is 'Mr. Dev'.
 - (iii) List names of players playing game basketball.
- (c) Consider the following relations :
- Item(ino, iname, iqty)
Po(pno, pdate, amt)
Suppliers(sno, sname, saddr)
- Item and Po are related with one to many relationship and
supplier and po are one to many relationship. Create RDB
for above and solve queries :
- (i) Find out p no, p date and supplier name of the po
which is of maximum amount.
 - (ii) List names of suppliers to whom po is given for
'Mouse'.
 - (iii) List names of suppliers and item name in pos
generated on 30 'Dec. 2010'.
- (d) Consider the following relations :
- Doctor(docno, name, specialization)
Hospital(hospno, name, addr)
- Doctor and Hospital are related with many to many
relation. Create RDB for above and solve queries :
- (i) List names of doctors visiting 'Padghan Hospital' on
Monday.
 - (ii) List names of Hospitals in 'Pune City' which have
more than 10 doctors of 'Surgeon' specialization
visiting it.
 - (iii) Delete all doctors with specialization 'gynaec'.

(B) Answer the following : (Any One) [5x1=05]

(a) Consider the following relations :

Musician(m_no, m_name, age, m_city)

Instrument(i_no, i_name)

Plays(m_no, i_no)

Solve the following algebraic queries :

(i) List all musicians having age between 30 to 40 years.

(ii) List all instruments which 'Mr. Ravikumar' plays.

(iii) List all 'violin' players who live in Mumbai and their age is below 30.

(iv) List all musicians who play at least one instrument that 'Mr. Ravikumar' plays.

(b) Consider relations :

Item(i_code, i_name, price)

Order(o_code, date, cust_name)

Item_order(i_code, o_code, qty)

Solve the following algebraic queries :

(i) List all items that are ordered by customers.

(ii) List all order numbers along with different items and respective items under them.

(iii) List all orders before 4th October, 2010.

(iv) List all items along with their prices.

(v) Find most costly item.

Q.5) (A) Car Insurance Company has a set of customers, each of whom owns one or more cars. Each car is associated with zero to any number of recorded accidents :

(i) Draw Entity Relationship Diagram.

(ii) Convert E-R Diagram in 3Nf. [07]

(B) Explain symbols which are used to draw entity relationship diagram. [03]

OR

(B) 'Relational Algebra is an example of procedural DML'. Comment. [03]

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F. Y. B. Sc. (Computer Science) Examination - 2011

MATHEMATICS

PAPER - I

DISCRETE MATHEMATICS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
 - (2) *Figures to the right indicate full marks.*
 - (3) *Neat diagrams must be drawn wherever necessary.*
-
-

Q.1) Attempt **each** of the following :

[16]

- (a) A farmer buys 3 cows, 2 goats and 4 hens from a man who has 4 cows, 3 goats and 8 hens. How many choices does the farmer have ?
- (b) What rule of inference is used in the following argument ?
“Alice is a mathematics major. Therefore, Alice is either mathematics major or a computer science major.”
- (c) Write recurrence relation for the sequence 2, 5, 8, 11,.....
- (d) State generalised first principle of mathematical induction.
- (e) State true or false with justification :
“There does not exist a complete graph on $p(p > 2)$ vertices which is bipartite graph.”
- (f) Find maximum edge connectivity of a graph having 10 vertices and 16 edges.
- (g) Does there exist a binary tree with 6162 vertices ? Justify.
- (h) Give an example of a self complementary graph on 5 vertices.

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

[16]

(a) Solve recurrence relation :

$$b_n = 3b_{n-1} - 2b_{n-2}, \text{ with initial conditions } b_1 = 5, b_2 = 3.$$

(b) How many friends must you have to guarantee that atleast 10 of them will have birthday in the same month ?

(c) Using mathematical induction, prove that,

$$10^n + (3)4^{n+2} + 5 \text{ is divisible by } 9,$$

for any positive integer n.

(d) Test validity of the following argument by using method of indirect proof :

“If my brother stands first in the class, I give him a T-shirt. Either he stood first or I was out of station. I did not give him a T-shirt. Therefore, I was out of station.”

(e) Sort the following array by using bubble sort :

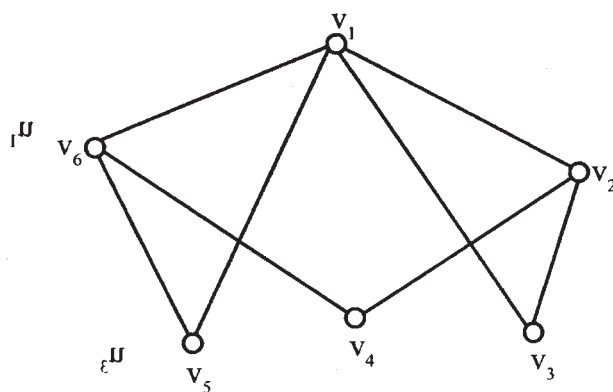
9, 11, 5, 25, 18.

(f) How many different numbers can be formed from the digits 0, 2, 3, 4, 5, 6 lying between 100 and 1000 in which no digit being repeated ? How many of them are not divisible by 5 ?

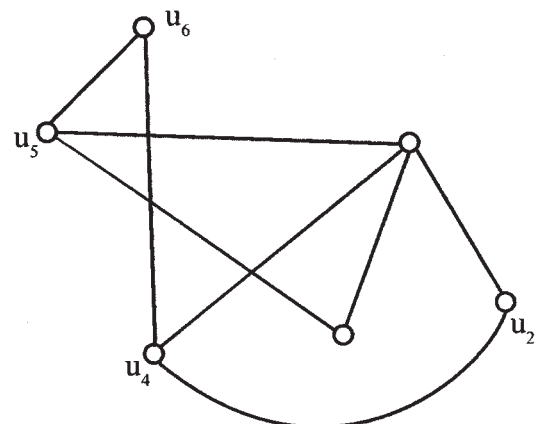
Q.3) Attempt **any four** of the following :

[16]

(a) Show that the following graphs are isomorphic :

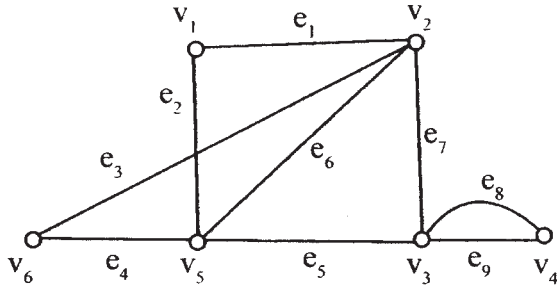


(G₁)

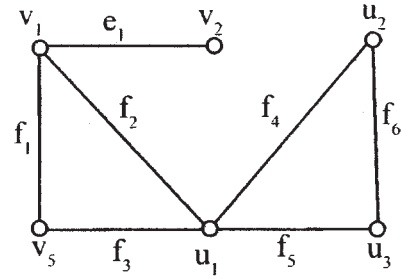


(G₂)

(b) Find $G_1 \cap G_2$ and $G_1 \oplus G_2$ for the following graphs :



(G_1)



(G_2)

(c) If G is a simple graph on n vertices and q edges with k components, then prove that $n - k \leq q$.

(d) Define the following terms :

- (i) Complete Bipartite Graph
- (ii) Asymmetric Diagraph
- (iii) Spanning Tree of a Graph
- (iv) Weighted Graph

(e) For the following expression draw arborescence and write expression in Polish notation :

$$f + \frac{ab}{\frac{c}{3} + d^4 - e}$$

(f) Define adjacency matrix of a graph and draw graph whose adjacency matrix is given below :

$$\begin{bmatrix} 0 & 3 & 0 & 0 & 0 & 1 \\ 3 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 2 \end{bmatrix}$$

Q.4) Attempt any two of the following :

[16]

(a) Solve recurrence relation

$$a_r + 3a_{r-1} + 3a_{r-2} + a_{r-3} = r,$$

where $a_0 = -1, a_1 = 2, a_2 = 3.$

(b) (i) Prove by induction that,

$$1.1! + 2.2! + 3.3! + \dots + n.n! = (n + 1)! - 1$$

(ii) Let $\phi(x, y)$ denote “ $x + y = 0$ ” and $U = \mathbb{IR}.$

Write truth values of the following with justification.

(1) $\exists y \forall x \phi(x, y)$

(2) $\forall x \exists y \phi(x, y)$

(c) Write an algorithm to sort an array by using insertion sort. Hence sort the following array :

2, 14, 9, 12, 8, 3, 17.

(d) (i) How many integers are there between 100 and 999 inclusive that are divisible by 3 but not by 4 ?

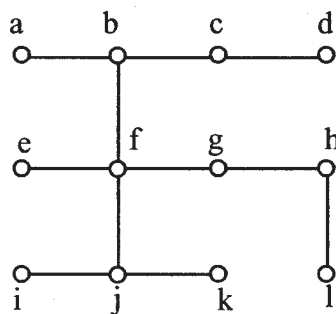
(ii) Test validity of the following argument :

$$R \rightarrow C, S \rightarrow \sim W, R \vee S, W \vdash C.$$

Q.5) Attempt any two of the following :

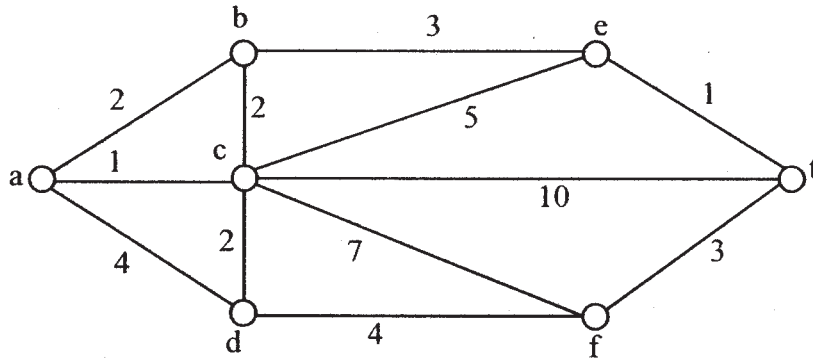
[16]

(a) (i) Find centre, radius and diameter of the following tree :



(ii) Draw graph $K_{4,3}$ and find its vertex connectivity and edge connectivity.

- (b) Using Dijkstra's Algorithm, find shortest path from the vertex 'a' to the vertex 't' in the following graph :



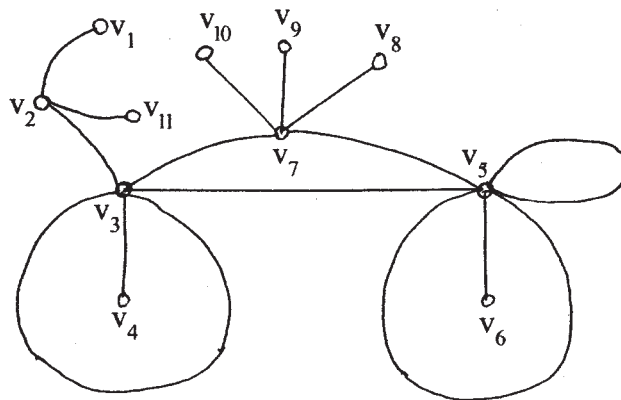
- (c) (i) A tree has 2 vertices of degree 2, 1 vertex of degree 3 and 3 vertices of degree 4.

Find number of vertices of degree 1 in the tree.

- (ii) For the graph G given below, draw the following subgraphs :

(1) $\langle H \rangle$; $H = \{v_2, v_3, v_5\}$

(2) $G - \{v_3, v_7\}$

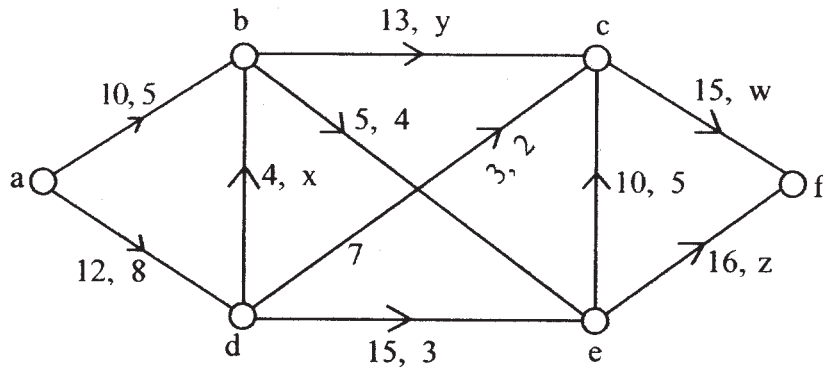


(G)

- (d) (i) Define :

- (1) Network
- (2) Saturated edge in a Network

(ii) Find values of x , y , z and w in the following network :



Total No. of Questions : 5]

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F. Y. B. Sc. (Computer Science) Examination - 2011

MATHEMATICS

PAPER - II

ALGEBRA AND CALCULUS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) All questions are compulsory.
 - (2) Figures to the right indicate full marks.
 - (3) Neat diagrams must be drawn wherever necessary.
-

Q.1) Attempt **each** of the following :

[16]

- (a) Let $X = \{e, f, g, h\}$ be any set. Construct example of a relation on X which is :
 - (i) Symmetric and reflexive but not transitive.
 - (ii) Transitive and symmetric but not reflexive.
- (b) Let a, b, x be any integers, then show that $(a, b) = (a, b + ax)$.
- (c) Let $A = \{1, 2, 4, 5, 10, 20\}$ be a poset on partially ordered relation ' \leq ' is 'divides'. Draw Hasse Diagram for relation.
- (d) Give an example of a lattice which is not distributive but complemented. Justify.
- (e) Test convergence of the sequence $\{x_n\}$, where

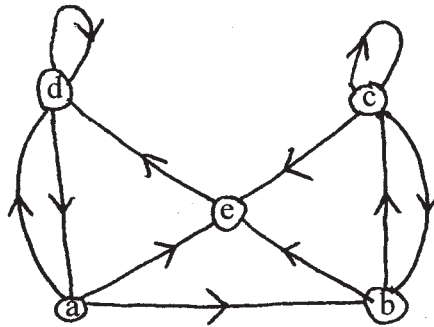
$$x_n = \frac{3n - 9999}{2n - 8888}, \forall n \in \mathbb{N}.$$

- (f) Show that the series $1 + 0.5 + (0.5)^2 + (0.5)^3 + \dots$ converges to 2.
- (g) Is every continuous function always differentiable ? Justify.
- (h) If $y = \frac{1}{x^2 - x - 2}$, find y_n .

Q.2) Attempt any four of the following :

[16]

- (a) State and prove Euclid's Lemma for integers.
- (b) Let R be a relation on \mathbb{Z} defined as 'xRy if and only if $6x + 7y$ is divisible by 13'. Show that R is an equivalence relation on \mathbb{Z} .
- (c) The digraph of relation R on set $A = \{a, b, c, d, e\}$ is as follows :



Find relation R and also obtain matrix of relation R .

- (d) Let p and q be any two primes, then show that $p^{q-1} + q^{p-1}$ is congruent to 1 modulo pq .
- (e) If the join operation is distributive over the meet operation in a lattice, then prove that the meet operation is also distributive over the join operation.
- (f) Show that $[B_2^2, -, \vee, \wedge]$ is Boolean Algebra. Find atoms of this Boolean Algebra.

Q.3) Attempt any four of the following :

[16]

(a) Let $a_1 = 2$ and $a_{n+1} = 2 - \frac{1}{a_n}$, $\forall n \in \mathbb{N}$. Show that sequence $\{a_n\}$ is convergent.

(b) Discuss convergence of the series :

$$\sum \left(1 + \frac{1}{n}\right)^{-n^2} \cdot e^{-n}$$

(c) Find values of α and β if function is continuous in $(-2, 3)$, where

$$f(x) = \begin{cases} 4x + 5 & \text{if } -2 < x < 0 \\ 2x + \alpha & \text{if } 0 \leq x < 1 \\ x - 3\beta & \text{if } 1 \leq x < 3 \end{cases}$$

(d) State and prove Cauchy's Mean Value Theorem.

(e) If $y = \cos^2 x \sin x$, find n^{th} derivative of y .

(f) Evaluate :

$$\lim_{x \rightarrow 0} \frac{x \cos x - \log(1 + x)}{x \sin x}$$

Q.4) Attempt any two of the following :

[16]

(a) Let $A = \{a, b, c, d\}$ be any set and R be a relation defined on A as

$$R = \{(a, a), (a, c), (b, a), (b, b), (c, b), (c, c), (d, d), (d, c)\}.$$

Obtain transitive closure of R using Warshall's Algorithm.

(b) Find greatest common divisor of 1718 and 8171. Hence find m and n such that $d = 8171m + 1718n$.

- (c) (i) Show that the congruence relation modulo n on set of integers is an equivalent relation.
- (ii) Find remainder when 17^{1402} is divided by 13.
- (d) Simplify and write disjunctive normal form of Boolean Expression
- $$f(x, y, z) = x \wedge (\overline{y \vee z}) \vee \{[(x \wedge y) \wedge \bar{z}] \wedge x\}.$$

Q.5) Attempt any two of the following :

[16]

- (a) State Leibnitz Theorem and prove that
- $$(1 - x^2) y_{n+2} - (2n + 1) x y_{n+1} - n^2 y_n = 0$$
- if $y = (\sin^{-1} x)^2$.
- (b) (i) Using Lagrange's Mean Value Theorem, find approximate value of $\sqrt{88}$.
- (ii) Evaluate : $\lim_{x \rightarrow 0} [\cos(ax)]^{b/x^2}$
- (c) Assuming the validity of expansion, expand $e^x \sin x$ in ascending powers of $\left(x - \frac{\pi}{4}\right)$ upto five terms.
- (d) (i) Show that the sequence $\{x_n\}$, where

$$x_n = \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \dots + \frac{1}{n!} \text{ is convergent.}$$

- (ii) Discuss convergence of p -series

$$\sum_{n=1}^{\infty} \frac{1}{n^p} \text{ for } p > 1.$$

Total No. of Questions : 5]

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F. Y. B. Sc. (Computer Science) Examination - 2011

ELECTRONICS

PAPER - I

ELECTRONIC DEVICES, CIRCUITS AND COMPUTER PERIPHERALS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
 - (2) *Use of non-programmable electronic calculator is allowed.*
 - (3) *Draw neat diagram wherever necessary.*
-
-

Q.1) Attempt all of the following :

[8x2=16]

- (a) Give Statements of Superposition Theorem and Norton's Theorem.
- (b) Define the terms :
 - (i) Barrier Potential of Diode
 - (ii) PIV of the Diode
- (c) Draw symbols of :
 - (i) N-channel JFET
 - (ii) P-channel JFET
 - (iii) N-channel DEMOSFET
 - (iv) P-channel Eonly MOSFET
- (d) Define the terms with respect to BJT :
 - (i) DC Load Line
 - (ii) Q Point

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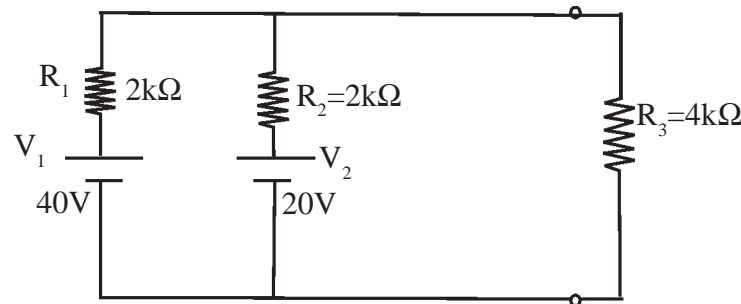
P.T.O.

- (e) Define the term Feedback. State which type of feedback is used in amplifier circuits.
- (f) Draw circuit diagram of Full Wave Rectifier using two diodes.
- (g) List any four Storage Devices used in Computer.
- (h) State conditions to obtain sustained oscillations in case of oscillator circuits.

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

[4x4=16]

- (a) Find current flowing through R_3 using Superposition Theorem :



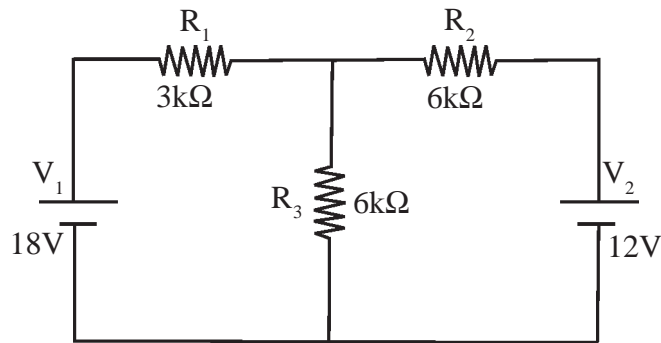
- (b) Compare BJT with FET. (any four points)
- (c) Explain operating principle of Optocoupler.
- (d) Explain working of NPN Transistor.
- (e) Draw circuit diagram for Colpitt's Oscillator and explain its working. Write an expression for output frequency.
- (f) State any four characteristics of Ideal Op-amp.

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

[4x4=16]

- (a) Explain action of reverse biased PN Junction Diode.
- (b) Draw circuit diagram of Integrator. Derive an expression for its output voltage.

- (c) Find current flowing through R_3 using Kirchoff's Laws :



- (d) Draw circuit diagram of Phase Shift Oscillator. If $R = 10k\Omega$ and $C = 0.01 \text{ F}$, find frequency of Oscillation for Phase Shift Oscillator.
- (e) Explain working principle of Switch Mode Power Supply (SMPS).
- (f) Explain need of Multistage Amplifier. In three stage amplifier $A_1 = 50$, $A_2 = 100$, $A_3 = 20$ find total gain in dB.

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

[2x8=16]

- (a) (i) Explain Zener Diode as a Voltage Regulator.
- (ii) Define the terms with respect to Power Supply :
- (1) Ripple Factor
 - (2) Conversion Efficiency
 - (3) Load Regulation
 - (4) Line Regulation
- (b) Explain working principles of :
- (i) Joy Stick
 - (ii) Flat Bed Scanner
- (c) Explain working principles of :
- (i) Optical Mouse
 - (ii) Light Pen
- (d) (i) Explain how transistor is used as Audio Amplifier.
- (ii) Define α and β . Derive an expression for α in terms of β .

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

[16x1=16]

- (a) (i) (1) Draw circuit of Op-amp as Subtractor. Derive an expression for its output voltage.
- (2) Explain virtual ground concept in case of Op-amp.
- (ii) (1) Explain working principle of N-channel JFET.
- (2) Define the terms with respect to FET :
 - (i) DC drain Resistance
 - (ii) AC drain Resistance
 - (iii) Trans Conductance
 - (iv) Amplification Factor
- (b) (i) (1) Draw circuit diagram of online UPS. State its any two applications.
- (2) Explain Concept of Spike Protector with proper circuit diagram.
- (ii) Draw block diagram of Inkjet Printer. Explain its working. State its advantages over Dot Matrix Printer.

Total No. of Questions : 5]

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F. Y. B. Sc. (Computer Science) Examination - 2011

ELECTRONICS

PAPER - II

FUNDAMENTALS OF DIGITAL ELECTRONICS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
- (2) *Use of non-programmable calculator is allowed.*
- (3) *Draw neat diagrams wherever necessary.*

Q.1) Attempt all of the following :

[2x8=16]

- (a) What is 1's Complement of a Binary Number ? Give an example.
- (b) Write names of any two Logic Families.
- (c) Find number of select lines required in a 64 : 1 Multiplexer.
- (d) What is the difference between a Level Triggered and Edge Triggered Flip Flop ?
- (e) Explain Concept of Quasi-stable State in a Multivibrator.
- (f) What is the working principle of EEPROM ?
- (g) Define Resolution and Accuracy of DAC.
- (h) Write full form of ARM and ASIC.

Q.2) Answer any four of the following : [4x4=16]

- (a) What are the differences between Assembly and High Level Language Programming ?
- (b) Draw logic diagram and explain working of Crystal Clock using Inverters.
- (c) Draw logic diagrams of 4-bit SISO and PIPO Shift Registers.
- (d) State and prove De'Morgan's Theorems.
- (e) Perform the following binary operation using 2's Complement Method :
 $(10101001)_2 - (10111010)_2$
- (f) Draw block diagram and explain working of Dual Slope ADC.

Q.3) Answer any four of the following : [4x4=16]

- (a) Draw Memory Organisation for doubling word capacity of 16×4 memory using 16×4 memory chips.
- (b) Explain Half Subtractor with neat diagram and truth table.
- (c) Draw symbols of any four logic gates and give their truth tables.
- (d) Differentiate between RISC and CISC.
- (e) Perform the following conversions :
 - (i) $(1101)_2 = (?)_{\text{Gray}}$
 - (ii) $(0111)_2 = (?)_{\text{Gray}}$
 - (iii) $(1111)_{\text{Gray}} = (?)_{\text{Binary}}$
 - (iv) $(0110)_{\text{Gray}} = (?)_2$
- (f) Using Thevenin's Theorem, solve 4-bit R-2R DAC for input $(1000)_2$. Given logic 1 = 7V and logic 0 = 0V.

Q.4) Answer **any two** of the following :

[2x8=16]

- (a) Minimise the following expression using K-map and realise using logic gates :

$$f = m(0, 1, 2, 3, 11, 12, 14, 15) + d(5, 6).$$

- (b) Explain 4-bit parallel adder with neat diagram. If the inputs given to the adder are $A = (1100)_2$ and $B = (1110)_2$, what will be the final carry generated by the circuit ? For 10-bit parallel adder, how many full adders and half adders are required ?
- (c) Draw master slave pulse triggered JK Flip Flop and explain its operation. What is the advantage of MS JK Flip Flop over JK Flip Flop ?
- (d) Perform the following conversions :
- (i) $(AF9 \cdot BOD)_{16} = (?)_2$
- (ii) $(463)_8 = (?)_{10}$
- (iii) $(1101101)_2 = (?)_{10}$
- (iv) $(256)_8 = (?)_{16}$

Q.5) Answer **any one** of the following :

[1x16=16]

- (a) (i) Draw and explain working of 1 : 8 Demultiplexer.
(ii) Explain 3-bit asynchronous up counter with logic diagram, truth table and timing diagram. (Use negative edge triggered clock)
- (b) (i) Write a note on Classification of Memory.
(ii) Draw internal diagram of IC-555 and explain different blocks in it.

Total No. of Questions : 5]

[Total No. of Printed Pages : 7

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F. Y. B. Sc. (Computer Science) Examination - 2011

STATISTICS

PAPER - I

STATISTICAL METHODS - I

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
 - (2) *Figures to the right indicate full marks.*
 - (3) *Use of single memory, non-programmable, scientific calculators and statistical tables is allowed.*
 - (4) *Symbols have their usual meanings unless otherwise stated.*
 - (5) *Calculator in cell phone is not allowed.*
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Q.1) Attempt **each** of the following :

[8x2=16]

- (a) In each of the following, state relationship between Mean, Median and Mode :
 - (i) Positively Skewed Distribution
 - (ii) Negatively Skewed Distribution
- (b) A variable takes values 1, 4, 9, 16,, 100. Find its Arithmetic Mean.

- (c) What type of correlation do you expect in the following situations ?
- (i) Consumption of Electricity and Amount of Electricity Bill
- (ii) Sale of Wollen Garments and Day Temperature
- (d) The mean height of 25 male workers in a factory is 161 cm and the mean height of 35 female workers in the same factory is 158 cm. Find mean height of all 60 workers in the factory.
- (e) Define Coefficient of Determination and its Utility.
- (f) If $b_{yx} = -1.8$, $b_{xy} = -0.2$ and $\text{var}(x) = 4$, find Standard Deviation of y and $\text{cov}(x, y)$.
- (g) State any four Process Control Tools.
- (h) For a trivariate data, compute $R_{2,13}$, $r_{12} = 0.6$, $r_{13} = 0.7$, $r_{23} = 0.65$.

Q.2) Attempt any four of the following :

[4x4=16]

- (a) Write a note on Stem and Leaf Diagram.
- (b) Find value of the median of the following distribution :

Daily Expenditure	Below 100	101-200	201-300	301-400	401-500	above 500
No. of Persons	69	167	207	65	58	27

- (c) Define procedure of finding mode from histogram.
- (d) What is Box Plot ? Draw Box Plot for the data set whose $Q_1 = 11.89$, $Q_2 = 15.87$, $Q_3 = 31.25$.

Minimum of Values = 5.02, Maximum of Values = 46.02.

- (e) What are Partition Values ? State their Utility. Comment on the validity of the given statement :

“Median of a data set is also second quartile, 5th decile and 45th percentile.”

- (f) Calculate Arithmetic Mean and Mode for the following data :

Daily Salary (Rs.)	Number of Workers
Below 400	0
Below 600	4
Below 800	14
Below 1000	33
Below 1200	45
Below 1400	49
Below 1600	50

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

[4x4=16]

- (a) Explain Concept of Relative Measures of Dispersion. How relative measures of dispersion are useful in analysis of data ?
- (b) Compute Quartile Deviation and Coefficient of Quartile Deviation for the following frequency distribution :

Runs Scored by Batsman in an Inning	35-40	40-45	45-50	50-55	55-60	60-65
No. of Batsmen	18	22	26	36	23	19

- (c) Distinguish between Raw and Central Moments. Write down formulae for obtaining Variance and Third Central Moment in terms of Raw Moments.
- (d) The Range, Arithmetic Mean and Standard Deviation of a group of 10 items is 20, 62, 10 respectively. If each observation is increased by 5, what will be the range and the coefficient of variation ?
- (e) What is Skewness ? Explain different types of Skewness of a Data Set.
- (f) From the information given below :

	Boys	Girls
Number	72	38
Mean Height (in inches)	68	61
Variance	9	6

- (i) Find combined standard deviation of height of boys and girls together.
- (ii) Decide between height of boys and height of girls, which is more consistent ?

Q.4) Attempt any two of the following :

[8x2=16]

- (a) (i) When are two variables said to be correlated ? What do you mean by Positive and Negative Correlation ? Give an example of each type.
- (ii) From the following data of height of brothers and sisters, calculate Spearman's Rank Correlation Coefficient and interpret result :

Height of Brothers (in cm) (X)	65	66	67	68	69	70	71
Height of Sisters (in cm) (Y)	67	68	66	69	72	72	69

- (b) (i) State any four properties of Regression Coefficients.
- (ii) Given the following data, obtain linear regression estimate of marks in Mathematics for 70 marks in English. Correlation coefficient between marks is $r = 0.62$.

	Mean	Standard Deviation
Marks in Maths	48.4	8.4
Marks in English	35.6	10.5

- (c) (i) Write stepwise procedure of fitting of a second degree curve $y = a + bx + cx^2$ using method of least squares.
- (ii) Estimate trend by 5-yearly Moving Average Method for the following data :

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Sales (Rs.'000)	50	36	43	44	38	58	32	38	41	41	33

- (d) (i) What is Time Series ? State Components of Time Series. State Additive and Multiplicative Models.
- (ii) Fit a straight line trend for the following data and estimate the value of production of steel for the year 1996 :

Year	1991	1992	1993	1994	1995
Production of Steel (in million tonnes)	72	75	65	80	85

Q.5) Attempt any two of the following :

[8x2=16]

- (a) (i) Explain Concept of Multiple Correlation and Partial Correlation in a Trivariate Data.
- (ii) If $r_{12} = 0.8$, $r_{23} = -0.56$, $r_{31} = -0.4$,
 $\sigma_1 = 10$, $\sigma_2 = 8$, $\sigma_3 = 5$, find $r_{23.1}$ and $b_{23.1}$.

- (b) Let X_1 , X_2 and X_3 be the heights in centimeters of son, mother and father respectively and sample on X_1 , X_2 and X_3 showed the following results :

$$\bar{X}_1 = 170, \bar{X}_2 = 160, \bar{X}_3 = 168$$

$$\sigma_1 = 2.4, \sigma_2 = 2.7, \sigma_3 = 2.7$$

$$r_{12} = 0.28, r_{13} = 0.49, r_{23} = 0.51$$

- (i) Obtain equation of least squares regression plane of X_1 on X_2 and X_3 .
- (ii) Estimate height of son when height of mother is 155cms and height of father is 160cms.
- (iii) Find value of multiple correlation coefficient of X_1 on X_2 and X_3 .
- (c) (i) Write a note on Autoregressive Model of Time Series.
- (ii) The length of rod is normally distributed. The process is in statistical control with $\bar{X} = 310$, $\bar{R} = 4.118$ for each subgroup of size 4. Given that the specifications are 310 ± 8 , find capability index and interpret its value and if the value of \bar{X} shifts to 308, find capability performance index and interpret result.

- (d) The following table gives values of the mean and range for 12 samples each of size 4. Construct R chart and \bar{X} chart and decide whether the process is under control.

[$n = 4$, $D_3 = 0$, $D_4 = 2.282$, $A_2 = 0.7290$]

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12
Mean	42	41	40	46	39	47	40	36	42	40	44	45
Range	5	3	7	1	6	3	3	5	3	5	3	5

Total No. of Questions : 5]

[Total No. of Printed Pages : 6

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F. Y. B. Sc. (Computer Science) Examination - 2011

STATISTICS

PAPER - II

STATISTICAL METHODS - II

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- (1) *All questions are compulsory.*
- (2) *Figures to the right indicate full marks.*
- (3) *Use of single memory, non-programmable, scientific calculator and statistical tables is allowed.*
- (5) *Calculator in cell-phone is not allowed.*
- (6) *Symbols have their usual meaning unless otherwise stated.*

Q.1) Attempt **each** of the following :

[8x2=16]

- (a) Explain the terms : Deterministic Experiments, Non-deterministic Experiments.
- (b) Given :

$$P(A) = 3/4 \text{ and } P(B) = 3/8$$

Show that

$$\frac{1}{8} \leq P(A \cap B) \leq 3/8$$

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P.T.O.

(c) Define each of the following :

Independence of two events, Partition of Sample Space.

(d) Obtain Median for the following probability distribution :

X	-2	-1	0	1	2
P(X=x)	0.2	0.2	0.2	0.3	0.1

(e) Define Probability Mass Function of a Discrete Random Variable.

(f) If X is Discrete Uniform Random Variable with Probability Mass Function as

$$P[X = x] = \begin{cases} k & ; \quad x = 5, 6, 7, \dots, 16, k > 0 \\ 0 & \text{o.w.} \end{cases}$$

Find mean of X.

(g) Define Pareto Distribution. State its Mean, Variance.

(h) Let $X \rightarrow N(100, 16)$. Calculate $P[90 \leq X \leq 110]$.

Q.2) Attempt any four of the following :

[4x4=16]

(a) Define each of the following :

Population, Sample, Mutually Exclusive Events, Conditional Probability.

(b) A shopping mall accepts either master card or visa card. The probability that customer will carry a master card is 0.24, the probability that he will carry visa card is 0.61 and will carry both, a master card and a visa card, with probability 0.11. What is the probability that he will carry (i) neither of the cards (ii) only one of the two cards ?

- (c) State and prove Addition Theorem of Probability.
- (d) Let A and B be two events defined on Ω such that $P(A) = 0.80$, $P(A \cap B) = 0.45$, $P(B) = 0.50$. Obtain $P(B/A)$, $P(A/B)$, $P(B/A')$, $P(A'/B')$.
- (e) Define (i) discrete random variable (ii) distribution function of a discrete random variable.

Also state any two properties of the distribution function of a discrete random variable.

- (f) Let X be a discrete random variable taking three values 10, 20, 30 with probabilities $3C^2$, $4C - 10C^2$, $5C - 1$.
- (i) Find 'C'
- (ii) Obtain distribution function of X.
- (iii) Plot distribution function obtained in (ii) above.

Q.3) Attempt any four of the following :

[4x4=16]

- (a) Define Binomial Distribution. State its additive property. Also state relation between Bernoulli Random Variable and Binomial Random Variable.
- (b) If X is Poisson Variable such that $P(X = 0) = 0.2$, find coefficient of variation of X. Also find $P(X \geq 2)$.
- (c) A shooter is hitting at a target. The probability of not hitting target at any shoot is 0.6. What is the probability that he will hit target at 4th attempt for the first time. Also find expected number of shoots required to hit target for the first time.
- (d) A roulette wheel is divided into 25 sectors of equal area numbered from 1 to 25. Let X be the number that occurs when the wheel is spun. Find (i) p.m.f. of X (ii) $P(X \geq 15)$ (iii) Mean of X (iv) Standard Deviation of X.

- (e) Describe how a Binomial Distribution can be approximated by a Poisson Distribution. Also give one example where it can be used.
- (f) If X has Uniform Distribution in $(-1, 3)$ and Y has Exponential Distribution with mean Q,
find Q such that $\text{var}(X) = \text{var}(Y)$

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

[2x8=16]

- (a) (i) Define each of the following :

Continuous Random Variable, Probability Density Function of Continuous Random Variable, Expectation of a Continuous Random Variable, Variance of a Continuous Random Variable.

- (ii) Suppose that X is a Continuous Random Variable whose p.d.f. is given by

$$f(x) = \begin{cases} C(4x - 2x^2) & 0 < x < 2 \\ 0 & \text{o.w.} \end{cases}$$

Find value of 'C' and $p(X \geq 1)$

- (b) (i) Define Continuous Uniform Distribution. State its variance, distribution function and one real life application where a continuous uniform distribution can be used.
- (ii) The amount of time that a watch will run without having to be reset is a random variable having an exponential distribution with mean 120 days. Find probability that such a watch will (i) have to be set in less than 24 days and (ii) not have to be reset in at least 180 days.

- (c) (i) A process yields 10% defective items. If 100 items are randomly selected from the process, using normal approximation find probability that the number of defectives (i) exceed 13 (ii) are less than 8.
- (ii) A group of 400 children is given an Intelligence Test. The average I.Q. of the group is found to be 105 with standard deviation 16. What proportion of the group will have I.Q. above 135 ? How many will have I.Q. below 85 ?
- (d) (i) Describe test procedure for testing hypothesis $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$ for a large sample at $\alpha\%$ level of significance.
- (ii) Two groups A and B each consisting of 100 people who have a disease. A serum is given to group A but not to group B (which is called the control group), otherwise, the two groups are treated identically. It is found that in groups A and B, 75 and 65 people, respectively, recover from the disease. Test hypothesis that the serum helps to cure disease using a level of significance of 5%.

Q.5) Attempt any two of the following :

[2x8=16]

- (a) (i) Explain procedure of obtaining a model sample from exponential distribution with mean Q.
- (ii) An engineer is concerned about the possibility that too many changes are being made in the setting of an automatic lathe. The following are mean diameters (in inches) of 15 successive shafts turned on the lathe :

0.261, 0.258, 0.249, 0.251, 0.247, 0.256, 0.25, 0.248, 0.255, 0.252, 0.253 0.266, 0.264, 0.263, 0.262.

Use run test to test hypothesis of randomness.

- (b) (i) Define each of the following :

Level of Significance, p-value, Critical Region, Type-II Error.

- (ii) The specifications for the production of a certain alloy call for 23.2% copper. A sample of 10 analyses of the product showed a mean copper content of 23.5% and standard deviation of 0.24%. Can we conclude at 5% l.o.s. that the product meets required specifications ?
- (c) (i) Explain procedure of testing $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ for a small sample at $\alpha\%$ l.o.s.
- (ii) On a particular proposal of national importance, the two parties, A and B, cast votes as shown below. At 1% l.o.s. test hypothesis that there is no difference between the two parties regarding the proposal.

	In favour	Opposed	Undecided
Party A	85	78	37
Party B	118	61	25

- (d) (i) Explain how sign test can be used in testing symmetry of the sample.
- (ii) Let $X_1 \rightarrow N(50, 30)$ and $X_2 \rightarrow N(80, 49)$ be two independent random variables.

Define $Y = X_1 - X_2$. State distribution of Y. Also find $P[|y| \leq 100]$.