

[4018] – 1

F. Y. B. Sc. (Computer Science) Examination, October – 2011

COMPUTER SCIENCE PAPER-I
(Introduction to Programming and 'C' Programming)**(JUNE 2008 PATTERN)****Time : Three Hours****Maximum Marks : 80***N.B. : (i) All questions are compulsory.**(ii) Figures appear at the right side are full marks.**(iii) Neat diagrams must be drawn wherever necessary.***Q. 1. Answer all the following questions (Any Ten) :****[10]**

- (1) Define - Algorithm and Flowchart.
- (2) Name fundamental data types of 'C' language.
- (3) What do you mean by Keywords?
- (4) What is the use of getchar () and putchar () functions?
- (5) What is the use of goto statement?
- (6) What do you mean by base address of an Array?
- (7) Find memory required for the following :

```
struct emp
{
    int emp-id;
    char name [20];
} employee;
```

- (8) What is Pointer Initialization?
- (9) Which header file is required for clrscr () function?
- (10) What is the use of #define statement?
- (11) State the use of rewind () function.
- (12) What is the use of '<<' and '>>' operators?

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

[20]

- (1) Explain the use of functions fprintf () and fscanf() with suitable example.
- (2) What do you mean by 'Array of Structures' and 'Array within Structures'?
- (3) Explain the methods of passing arguments to functions with example.
- (4) What is the difference between Static Memory Allocation and Dynamic Memory Allocation?
- (5) Explain the use of any **two** String Handling functions with syntax and example.

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

[20]

- (1) Write an Algorithm to calculate roots of quadratic equation.
(Consider all the **three** cases)
- (2) What is output of the following program?
main ()
{
 static char name [] = {'N', 'A', 'S', 'H', 'I', 'K', '\0'};
 printf ("%s\n", name);

```
printf ("%10 s\n", name);
printf ("%10 s\n", name);
printf ("% - 10s\n", name);
printf ("% - 10.2 s\n", name);
printf ("%2 s\n", name);
}
```

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

```
main ( )
{
    int x = 10;
    change (&x);
    printf ("X = %d", x);
}
change (int *y)
{
    *y= *y + 10;
}
```

- (4) Write a function which prints first 'n' terms of Fibonacci series.

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

```
main ( )
{
    int i ;
    for (i = 0; i < 5; i ++ )
        fl( );
}
fl( )
{
    static int count = 0;
    count = count + 1;
    printf ("% d\t", count);
}
```

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

[20]

- (1) Write a program to sort 'n' array elements in ascending order using dynamic memory allocation.
- (2) Write a program to create a structure student containing Roll no., Name and Percentage of marks. Read information of 'n' students and display records in descending order of percentage marks.
- (3) Write a program to copy contents of one file into another using command line argument.
- (4) Write a program which prints given matrix with its rowsums and columnsums.

i/p	o/p
1 2 3	1 2 3 6
4 5 6	4 5 6 15
7 8 9	7 8 9 24
	12 15 18 0

- (5) Write a program to calculate $y = x^n$ using recursive function.

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

[10]

- (1) Write a note on backslash character constants.
- (2) Explain 'C' storage classes with example.
- (3) What is the difference between Structure and Union?



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

COMPUTER SCIENCE PAPER-II
(File Organisation and Fundamentals of Databases)

(JUNE 2008 PATTERN)

Time : Three Hours

Maximum Marks : 80

N.B. : (i) All questions are compulsory.

(ii) Figures appear at the right side are full marks.

(iii) Neat diagrams must be drawn wherever necessary.

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

[10]

- (1) Define first NF.
- (2) State any two functions of DBA.
- (3) Explain Division Operator.
- (4) What is generalised structure of SQL Query?
- (5) What is Referential Integrity?
- (6) Define Physical File.
- (7) Define Primary Index.
- (8) Define Data Dictionary.
- (9) What is a Candidate Key?
- (10) What is Clustering Index?
- (11) Write types of File Organization.
- (12) What is Strong Entity?

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

[20]

- (1) Explain B^+ tree Deletion Algorithm?
- (2) Write a note on functional components of DBMS.
- (3) State different types of relationship that can exist in Entity Sets in an E-R Model.
- (4) State entity constraint along with brief explanation.
- (5) Consider relation :

$R(A, B, C, D, E)$ with F define on R as

$F = \{A \rightarrow B, CD \rightarrow E, A \rightarrow C, B \rightarrow D, E \rightarrow A\}$

Compute the closure of f i.e. F^+

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

[20]

- (1) Explain various users of DBMS.
- (2) Differentiate between Specialization and Generalization.
- (3) What are the different types of Integrity Constraints that can be specified on Database?
- (4) Write a note on Multivalued Dependency.
- (5) Discuss Memory Hierarchy with diagrams.

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

[15]

(a) Consider the following relation :

Wholesaler (w-no, w-name, addr. city)

Product (p-no, p-name)

Wholesaler and product are related with many to many relationship.

Create a Relational Database for the above and convert it in 3NF and solve the following queries in SQL :

(1) List all the wholesaler of product 'book's.

(2) Count the no. of wholesaler in the city 'Mumbai'.

(3) To print wholesalerwise product.

(b) Consider the following relation :

Department (d-no, name, manager-name)

Module (module-no, name)

Module-leader (leader-id, name, remuneration)

Relationship between department and module is one to many and relationship between module and module-leader getting higher remuneration.

Create a Relational Database for the above and convert it in 3NF and solve the following queries in SQL :

- (1) Count the no. of module for each department.
- (2) Give the name of module-leader getting higher remuneration.
- (3) Increase and update the remuneration of module leader responsible for module name 'ABC' by 15%.

(c) Consider the following relation :

Company (cid, cproduct, ename, region, state)

Branches (bproduct, city)

Company and branches are related with one to many relationship.

Create Relational Database for the above and convert it in 3NF and solve the following queries in SQL.

- (1) List all cities having branch product 'CPU' and 'Keyboard'.
- (2) List all states whose branch product is Harddisk.
- (3) Print citywise branches in descending order.

(d) Consider the following relation :

Sailors (sid, sname, rate, age)

Boats (bid, bname, colors)

Reserves (sid, bid, day)

Sailors and boats are related to one to many relationship and boat and reserve are many to many relationship.

Create relational database for the above and convert it in 3NF and solve the following queries in SQL :

- (1) Find names and ages of all sailors.
- (2) Find all the sailors with a rating above 8.
- (3) Find the names of sailors who have reserved boat no.103.

(B) Answer the following questions (Any One) :

[5]

(a) Consider the following relationships :

Student (sno, name, addr, class)

Subject (sub-no. name)

Student and subject are related with many to many with attribute marks.

Solve the queries in relational algebra :

- (1) List studentwise list of subjects.
- (2) Find the total no. of students for each subject.
- (3) Find the name of students who had opted for the course of 'Computer Science'.
- (4) Find the no. of students having address as 'Model Colony' and marks less than 60.
- (5) Print the classwise student.

(b) Consider the following relationships :

Property (pno, description, area)

District (dcode, dname, tax-rate)

Owner (oname, addr, phone)

Solve the queries in relational algebra :

- (1) List all properties in 'Mumbai' district.
- (2) Delete all properties from 'Aurangabad' district owned by 'Mr Poul'.
- (3) List the name of the owner and district in which the property is situated.
- (4) List districtwise properties of the owner.
- (5) Print the list of owners in a particular district.

Q. 5. (A) “Star” is an agency for flat booking and it has a number of builders and agents who are jointly working. A customer can get a flat for residential or commercial purpose. If customer is approached through agent then agency and builders are giving some commission to agent. Agent shows various flats and sites within various locations.

(1) Draw an E.R. diagram.

(2) Convert Entity-Relationship diagram into relational database in 3NF. [7]

(B) State the rules of conversion of E-R. diagram to table. [3]

OR

(B) What is Boyce Codd Normal Form (BCNF)? [3]



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

MATHEMATICS PAPER-I
(Discrete Mathematics)**(2008 PATTERN)****Time : Three Hours****Maximum Marks : 80***N. B. : (i) All questions are compulsory.**(ii) Figures appear at the right side are full marks.**(iii) Neat diagrams must be drawn wherever necessary.***Q. 1. Attempt All of the following questions :****[16]**

- (a) State the first principle of mathematical induction.
- (b) State Pigeon-hole principle.
- (c) Solve the recurrence relation :

$$a_n - 6a_{n-1} + 9a_{n-2} = 0$$

- (d) Prove the following equivalence using truth table :

$$p \rightarrow q \equiv \neg q \rightarrow \neg p$$

- (e) Define Big - O notation.
- (f) Determine if there exists a graph on five vertices with degrees.:
4, 3, 2, 1, 1

- (g) How many integers between 1 to 200 are divisible by 7 or 11?
- (h) Draw the graphs :
- (i) Complete bipartite graph on 6 vertices.
- (ii) Regular graph with degree 4.

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

[16]

- (a) Prove that :

$$3^n > 2^n + 64; \forall n \geq 4.$$

- (b) How many **four** digit numbers can be formed from the digits 1, 2, 3, 4 and 5, with repetition possible, which are divisible by 5.
- (c) Test the validity of the following argument :

$$R \rightarrow C, S \rightarrow -W, RVS, W + C$$

- (d) Solve the recurrence relation :

$$a_n = 3a_{n-1} + 4a_{n-2}; n \geq 2 \text{ and } a_0 = a_1 = 1$$

- (e) Arrange the following functions according to their growth. Write the justification also.

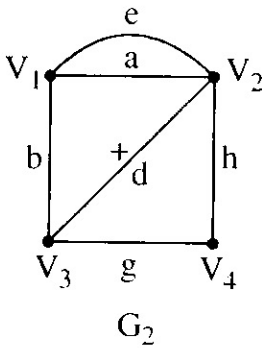
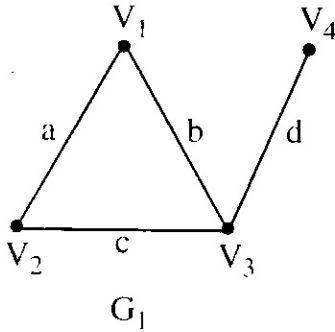
$$n, \log n, n \log n, 1, 2^n, n^2, n!$$

- (f) Show that if there are 30 students in a class, then at least two have last names that begin with the same letter.

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

[16]

(a) Find Union and Intersection of the following graphs :



(b) Let T be a binary tree on n vertices. Then show that T has $\frac{n+1}{2}$ pendant vertices.

(c) Draw the following graphs, whose

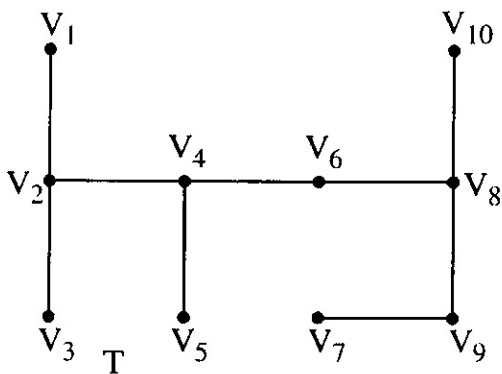
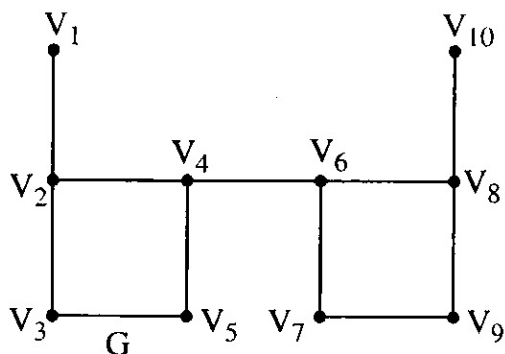
(i) adjacency matrix is

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

(ii) adjacency matrix is

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

(d) Obtain all fundamental circuits of the following graph G with respect to the given spanning tree T.



- (e) Draw the arborescence for the following algebraic expression and write it in Polish notation.

$$p + \frac{q \cdot a}{\frac{c}{3} + d^4 - e}$$

- (f) If G is a self-complementary graph on n vertices, then prove that n is of the form $4k$ or $4k + 1$, for some integer k .

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

[16]

- (a) 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 did not have a TV set; 175 had a Computer and 50 had neither a TV set nor a Computer. Find the number of students who
- live in a hostel.
 - have both a TV set and a Computer.
 - have only a Computer.
- (b) If Tina marries Rahul, she will be in Pune. If Tina marries Ganesh, she will be in Mumbai. If she is either in Pune or Mumbai, she will definitely be settled in life. But Tina is not settled in life. Therefore she did not marry either Rahul or Ganesh. (R, P, G, M, S).

(c) Sort the following array using Bubble sort. Write all the steps :

13, 2, 4, -1, 10, 0

(d) State and prove Multiplication Principle.

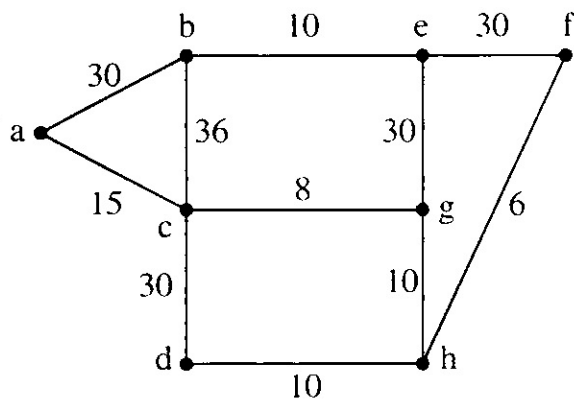
Q. 5. Attempt any **Two** of the following :

[16]

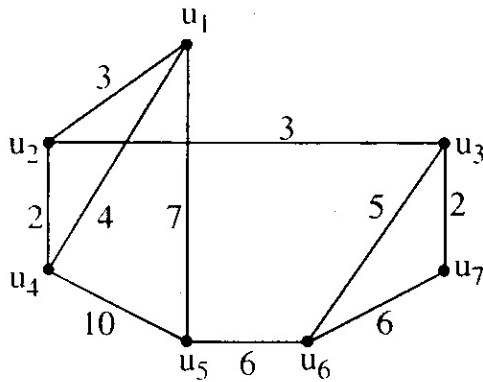
(a) (i) If T is a tree on n vertices, then prove that T has $(n - 1)$ edges.

(ii) If u and v are any two distinct vertices of T , then prove that there exists exactly one path in between u and v .

(b) Use Dijkstra's algorithm to obtain shortest path from a to f in the following graph :



- (c) Use Kruskal's algorithm to obtain shortest spanning tree of the following graph :



- (d) Define vertex connectivity and edge connectivity of a connected graph. Also determine vertex and edge connectivity of a complete bipartite graph $K_{m,n}$.



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

MATHEMATICS PAPER-II

(Algebra and Calculus)

(NEW 2008 PATTERN)

Time : Three Hours

Maximum Marks : 80

N. B. : (i) All questions are compulsory.

(ii) Figures appear at the right side are full marks.

(iii) Neat diagrams must be drawn wherever necessary.

Q. 1. Attempt All of the following questions :

[16]

(a) Let $A = \{a, b, c, d\}$. Determine whether following relation R on A is transitive or not; where $R = \{(a, a), (a, b), (b, c)\}$. Justify.

(b) Let $B = \{x, y, z\}$. Write the relation R whose matrix is given below :

$$M(R) = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(c) Find the greatest common divisor for 263 and 52.

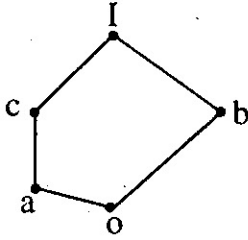
(d) State Idempotent and Absorption laws.

(e) State Rolle's theorem.

(f) Find n^{th} derivative of the following function :

$$y = \frac{1}{x^2 - 4x + 3}$$

- (g) Consider the lattice represented by following Hasse diagram :



Determine whether it is distributive or not with justification.

- (h) Test whether the sequence $\{x_n\}$, where $x_n = (-1)^n$, is bounded or not.

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

[16]

- (a) Show that $\sqrt{5}$ is not a rational number.
- (b) Find the conjunctive normal form of Boolean expression

$$E(x, y) = (x \vee \bar{y}) \wedge (x \wedge \bar{y})$$
- (c) Prove that for any **two** integers a and b, $a \equiv b \pmod{n}$ if a and b leaves the same remainder when divided by n.
- (d) Find gcd of 2210 and 357 and express it in the form
 $(2210)m + (357)n$.
- (e) Draw the Hasse diagram of the poset D_{42} , the set of all divisors of 42 with respect to partial ordering relation "divides".
- (f) Prove that any **two** equivalence classes are either disjoint or identical.

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

[16]

- (a) . Show that the sequence $\{x_n\}$, where $x_n = \frac{2n}{3n+4}$, is monotonic increasing, bounded above.

- (b) Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$.
- (c) Test the continuity of the following function at the origin

$$f(x) \begin{cases} \frac{x-|x|}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

- (d) Expand $x^4 - 5x^3 + x^2 - 3x + 4$ in the powers of $(x-1)$.
- (e) Verify LMVT for the function $f(x) = \sin x + \cos x$ on $\left[0, \frac{\pi}{2}\right]$
- (f) Find $\lim_{x \rightarrow 0} \frac{a^x - 1}{b^x - 1}$ by L'Hospital's rule.

Q. 4. Attempt any Two of the following :

[16]

- (a) Find the disjunctive normal form for the function :

$$f(x, y, z) = x \wedge (y \vee z)$$

- (b) Let $R = \{(1, 1), (1, 3), (2, 2), (2, 4), (3, 3), (3, 1), (4, 4), (4, 2)\}$ be the relation on $A = \{1, 2, 3, 4\}$.

Show that R is an equivalence relation on A . Also write down the equivalence classes with respect to relation R .

- (c) Let p be the prime number and $a, b \in \mathbb{Z}$ then, prove that

$$(1) \quad p | ab \Rightarrow p | a \text{ or } p | b$$

$$(2) \quad \text{if } p \nmid a \text{ then } a^{p-1} \equiv 1 \pmod{p}$$

- (d) Write down the transitive closure of $R = \{(a, b), (b, b), (b, c), (c, a), (c, b)\}$, a relation defined on set $A = \{a, b, c\}$, by using Warshall's algorithm.

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

[16]

- (a) State Leibnitz's theorem –

If $y = \tan^{-1} x$ then prove that

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

- (b) (i) Verify LMVT and find C if possible for the function

$$f(x) = x - x^3 \text{ on } [-2, 1]$$

(ii) Evaluate $\lim_{x \rightarrow 1} \left[\frac{x}{x-1} - \frac{1}{\log x} \right]$

- (c) State Maclaurin's theorem and use it to find power series expansion of $\sin 2x$.

- (d) State Cauchy's n^{th} root test and hence discuss convergence of

$$\text{series } \sum_{n=1}^{\infty} \left(\frac{n}{1+n} \right)^{n^2}$$

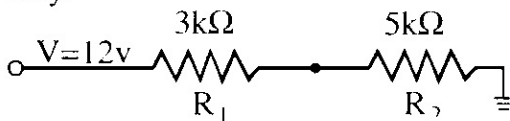


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F. Y. B. Sc. (Computer Science) Examination, October – 2011

ELECTRONICS (PAPER - I)**(Electronic Devices, Circuits and Computer Peripherals)****(NEW 2008 PATTERN)****Time : Three Hours****Maximum Marks : 80***N.B. : (i) All questions are compulsory.**(ii) Use of non-programmable electronic calculator is allowed.**(iii) Draw neat diagrams wherever necessary.***Q.1.** Attempt **all** of the following questions :**[16]**

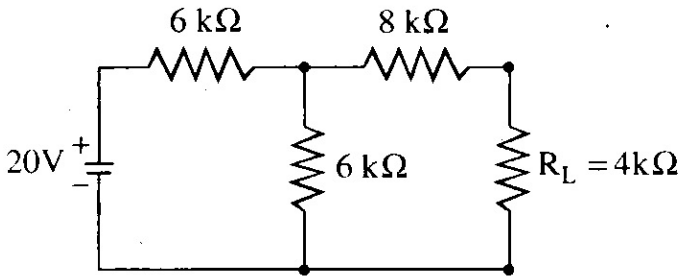
- (a) Draw the typical nature of I-V characteristics of P-N junction diode.
- (b) Draw the symbols of NPN and PNP transistors. State different configurations of BJT.
- (c) State any **four** applications of FET.
- (d) Explain the need of multistage amplifier.
- (e) In a Colpitt's oscillator circuit, if $L = 0.5 \text{ mH}$ and $C_{\text{equi}} = 0.01 \mu\text{F}$. Find the frequency of oscillation.
- (f) Compare full wave and bridge rectifier circuits.
(Any TWO points)
- (g) State the advantages of LASER printer over dot matrix printer.
- (h) Find the voltage across resistor R_2 using potential divider rule only.



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

[16]

- Explain Zener breakdown mechanism in brief. Draw symbols for Zener diode and Photo diode.
- Explain the concept of MOS capacitor.
- Explain BJT as a voltage amplifier.
- Find the Thevenin's equivalent circuit for the following circuit :



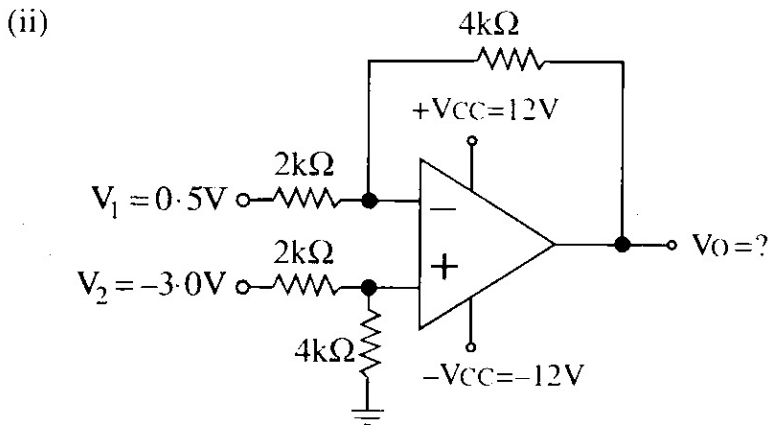
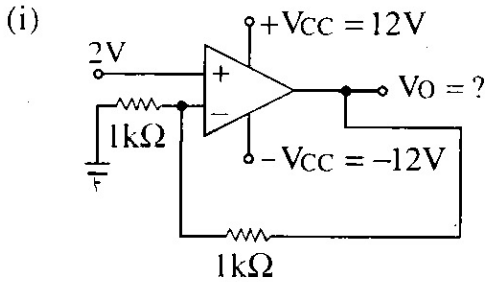
- What do you mean by direct-coupled amplifier? Draw circuit and frequency response nature for Two stage transistorised direct-coupled amplifier.
- State the Barkhausen criterion for sustained oscillations. Draw circuit diagram of phase shift oscillator.

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

[16]

- Explain OP-Amp inverting amplifier with proper circuit diagram. Find an expression for its output voltage.
- Draw the standard connection diagram for 3-pin positive voltage regulator. Define the terms - Line Regulation and Load Regulation.
- Explain the read operation of CD-ROM.
- Draw the circuit diagram of Hartley oscillator and explain its working in brief.
- Draw the block diagram of ON-line UPS and explain its working.

(f) Identify the configurations of OP-Amp and find the output voltages.

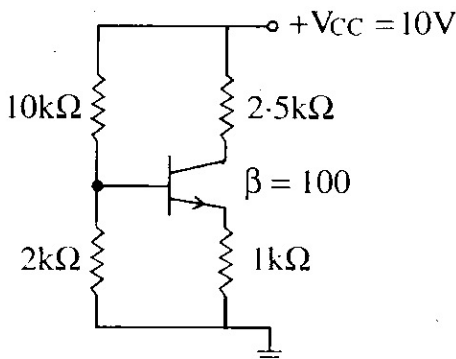


Q. 4. Attempt any **Two** of the following :

[16]

(a) Define the terms : DC load line and Q-point w. r. to transistor amplifier.

Draw the DC load line for the given circuit. State the biasing method used in the circuit.



Given, $V_{BE} = 0.7V$

- (b) Explain the working principle of N-channel E-only MOSFET.
Draw the typical nature of its :
- (i) Drain characteristics
 - (ii) Transfer characteristics
- (c) (i) Give the statements of :
- (1) KVL
 - (2) KCL
 - (3) Superposition theorem
 - (4) Norton's theorem
- (ii) Explain the electronics in digitizer.
- (d) Explain the operating principle of dot-matrix printer. State its advantages and disadvantages.

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

[16]

- (a) (i) Draw the circuit diagram of OP-Amp differentiator. Find an expression for its output voltage.
In three input inverting OP-Amp adder circuit if, $V_1 = 0.5V$, $V_2 = 0.3V$, $V_3 = -0.2V$, where $R_1 = R_2 = R_3 = R = 10k\Omega$ and $R_f = 100k\Omega$.
Find the value of :
- (1) Output voltage
 - (2) Voltage gain
- (ii) (1) Explain the operating principle of photo-diode.
(2) Explain in brief Zener and Avalanche breakdown mechanism w. r. t. diode.
- (b) (i) Draw the block diagram of regulated power supply and explain role of each block. Explain the need of heat sink in power supply.
- (ii) (1) Explain the operating principle of LCD display.
(2) Explain the electronics in pen drive.



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

ELECTRONICS (PAPER - II)
(Fundamentals of Digital Electronics)

(NEW 2008 PATTERN)

Time : Three Hours

Maximum Marks : 80

N.B. : (i) All questions are compulsory.

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

(iii) Draw neat diagram wherever necessary.

Q. 1. Attempt all of the following questions :

[16]

- (a) What do you mean by Parity Bit? What is the purpose of adding Parity Bit?
- (b) Write the Boolean expressions of De' Morgan's Theorems.
- (c) What is the importance of Strobe Input in combinational circuits?
- (d) What is a Decade Counter? Give an IC functioning as decade counter.
- (e) What do you mean by Bistable Multivibrator?
- (f) What is the working principle of EPROM?
- (g) Define Monotonicity and Linearity of DAC.
- (h) Write full form of SIMD and ASIC.

Q. 2. Attempt any Four of the following :

[16]

- (a) What are the differences between Compiler and Interpreter?
- (b) Draw the circuit diagram of Astable Multivibrator using IC 555 and explain its working.
- (c) Draw the circuit diagram and explain the working of Four Bit Ring Counter.
- (d) Define Fan in, Fan out, Propagation Delay and Noise Margin of logic families.
- (e) What is a BCD code? Convert decimal number $(14)_{10}$ to BCD and to binary.
- (f) Explain the operation of 4 bit binary weighted resistor DAC.

Q. 3. Attempt any Four of the following :

[16]

- (a) Differentiate between Volatile and Non-volatile memory.
- (b) Draw the block diagram of Analog Multiplexer. Give the features of Analog Multiplexer.
- (c) Draw the symbols of Universal Logic Gates and give their truth table.
- (d) Differentiate between RISC and CISC.

- (e) Perform the following conversions.
- (i) $(217)_{10} = (?)_8$
- (ii) $(0.656)_{10} = (?)_2$
- (f) Explain 3-bit Flash ADC with neat diagram.

Q. 4. Attempt any Two of the following :

[16]

- (a) Minimize the following expression using K-map and realize using logic gates.

$$f = \Sigma m(1, 4, 6, 9, 10, 11, 14, 15) + d(0, 3)$$

- (b) Give the working of Half adder and Full adder with neat logic diagram. Give the truth table of each.
- (c) Explain 4-bit Bidirectional Shift Register with neat diagram.
- (d) Subtract $(27)_{10}$ from $(68)_{10}$ using 2's complement.

Q. 5. Attempt any One of the following :

[16]

- (a) (i) What is an Encoder? Draw and explain the working of 8 to 3 encoder.
- (ii) Draw the logic diagram of J-K Flip-Flop using 4 NAND gates. Explain its operation. Also write the truth table.

- (b) (i) Design a memory of capacity $4K \times 8$ using $1K \times 8$ memory chips.
- (ii) Draw the internal diagram of IC 555 and explain its blocks.



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

STATISTICS (PAPER - I)

(Statistical Methods - I)

(2008 PATTERN)

Time : Three Hours

Maximum Marks : 80

N. B. : (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 questions :

[16]

- (a) Define Mode and describe a situation where Mode is preferred to Mean.
- (b) Coefficients of variation of two groups of observations are 40% and 50% respectively and their standard deviations are 16 and 20. Find their arithmetic means.
- (c) Mode is larger than Mean by 5 and the variance is 121. Compute coefficient of skewness.

- (d) Interpret the following :
- (i) $r = 1$
 - (ii) $r = -0.8$
- (e) The regression coefficient of Y on X is -1.5 and X on Y is -0.2 . Find the value of correlation coefficient.
- (f) In a trivariate data the total correlation coefficients are: $r_{12} = 0.58$, $r_{13} = 0.6$ and $r_{23} = -0.95$. Are these values consistent?
- (g) State all components of time series.
- (h) Explain assignable causes of variation in quality control.

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

[16]

- (a) Define the following terms :
- (i) Variable
 - (ii) Class mark
 - (iii) Relative frequency
 - (iv) Frequency density

- (b) Represent the following data using stem and leaf chart :

11·2, 11·2, 12·9, 13·1, 10·8, 11·6, 11·7, 11·2, 11·1, 12·3, 12·4,
10·4, 11·7, 11·3, 11·3, 11·9, 12·0, 12·4, 10·3, 10·7.

- (c) The daily expenditure of 100 families is given below :

Expenditure (₹)	20–29	30–39	40–49	50–59	60–69
No. of families	24	?	27	?	15

If the mode of the distribution is 43, find the missing frequencies.

- (d) Explain a graphical method based on less than ogive for determining value of median used for a grouped frequency distribution.
- (e) Calculate the weighted mean of the first n natural numbers with the numbers themselves as weights.
- (f) Explain the concept of dispersion. Also state the requirements of a good measure of dispersion.

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

[16]

- (a) Construct Box plot to represent the data on weekly TV viewing times in hours for 15 people given below :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
25	41	27	32	43	66	35	31	15	5	34	26	32	38	16

- (b) Arithmetic mean and standard deviation of 12 items are 22 and 3 respectively. Later on it was observed that the item 32 was wrongly taken as 23. Compute correct mean and correct standard deviation.
- (c) The first four raw moments of a distribution are 2, 20, 40 and 200 respectively. Find first **four** central moments.
- (d) What is Kurtosis? State the Pearsonian coefficient of Kurtosis and interpret its value.
- (e) Explain absolute and relative measures of dispersion.
- (f) Explain positive and negative skewness with an example for each.

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

[16]

(a) For bivariate data :

$$n = 5, \Sigma x = 20, \Sigma x^2 = 90, \Sigma y = 20, \Sigma y^2 = 90, \Sigma xy = 75.$$

Compute correlation coefficient and interpret the result.

(b) State any **four** properties of regression coefficients.

(c) Describe briefly the procedure of fitting an exponential curve of the form $Y = ab^x$ for a bivariate data, where a and b are constants.

(d) The two lines of regression are $X - 4Y = 5$ and $X - 16Y = -64$.

Find :

(i) regression coefficient of X on Y

(ii) regression coefficient of Y on X

(iii) correlation coefficient

(e) Write a note on Scatter Diagram.

(f) For trivariate data, if $R_{1.23} = 1$, does it imply that $R_{3.12} = 1$?

Justify.

Q. 5. Attempt any Four of the following :

[16]

- (a) Explain the concept of multiple regression for a trivariate data with an illustration.
- (b) Calculate 5 yearly moving averages for the following data of the number of students studying in a college during 1990 to 1999.

Year :	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of students :	332	317	357	392	402	405	410	427	405	438

- (c) Explain additive and multiplicative models of time series analysis.
- (d) Calculate the value of $r_{12.3}$ when
- (i) $r_{12} = r_{13} = r_{23} = r$
- (ii) $r_{12} = r_{13} = r_{23} = 0.5$
- (e) In a trivariate distribution :

$$\delta_1 = 10, \delta_2 = 8, \delta_3 = 5$$

$$r_{12} = 0.8, r_{13} = 0.6, r_{23} = 0.5$$

Determine the regression equation of X_2 on X_1 and X_3 , if the variates are measured from their means.

- (f) Given below are the data relating to a machine process set to produce corrugated sheets of a given length.

Sample no. (of 5 each)	1	2	3	4	5	6	7	8	9	10
Sample Range	5	11	4	16	9	8	9	4	7	7

Draw range control chart. Comment on the state of production process, ($n = 5$, $D_3 = 0$, $D_4 = 2.115$)



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F. Y. B. Sc. (Computer Science) Examination, October – 2011

STATISTICS (PAPER - II)
(Statistical Methods - II)

(NEW 2008 PATTERN)

Time : Three Hours

Maximum Marks : 80

N. B. : (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 questions :

[16]

- (a) Define non-deterministic experiment with an example.
- (b) Let A and B be two events defined on the sample space Ω , such that $P(A) = 0.5$, $P(B) = 0.7$, $P(A \cap B) = 0.3$, then find $P(A \cup B)$ and $P(A' \cap B')$.
- (c) The probability distribution of a discrete random variable (r.v.) X is as follows :

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

Find distribution function of X.

- (d) Let $X \sim P(\lambda)$. If $P(X = 0) = 0.2$, find λ .
- (e) State lack of memory property of an exponential distribution.
- (f) Let $X \sim U(0, 10)$. Find mean and variance of random variable (r. v.) X .
- (g) What is Simulation ?
- (h) Let $X \sim N(\mu = 20, \sigma^2 = 16)$. Find $P(X > 25)$.

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

[16]

- (a) State Axioms of Probability. Hence, prove the following :
“For any event A defined on the sample space Ω , $0 \leq P(A) \leq 1$.”
- (b) Four cards are drawn at random from a well-shuffled pack of 52 playing cards. Find the probability that,
 - (i) they are spades
 - (ii) they belong to different suits.
- (c) Define the following terms :
Sample Space, Elementary Event, Complement of an Event, Conditional Probability.
- (d) Let A and B be two events defined on the sample space Ω with $P(A) = 0.26$, $P(B) = 0.38$, $P(A \cap B) = 0.16$. Find :
 - (i) $P(A|B)$
 - (ii) $P(A|B')$

- (c) Define independence of two events A and B defined on the sample space Ω .

Does independence of two events imply that the events are mutually exclusive? Justify your answer.

- (f) Following is the probability distribution of a discrete random variable X.

X	0	1	2	3	4
P[X = x]	k	2k	3k	4k	5k

Find : (i) k, (ii) $P(X < 2)$, (iii) Mode.

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

[16]

- (a) If X has the discrete uniform distribution with probability mass

function $P(x) = \frac{1}{n}$ for $x = 1, 2, \dots, n$, show that

(i) $E(X) = \frac{n+1}{2}$

(ii) $\text{Var.}(X) = \frac{n^2 - 1}{12}$

- (b) Define each of the following for a discrete random

variable (r. v.) X :

- (i) Probability mass function.
 (ii) Cumulative distribution function.

- (iii) Expectation.
 - (iv) Variance.
- (c) Let $X \sim B(10, 0.4)$. Find :
- (i) $P(X = 4)$
 - (ii) $P(X \geq 3)$
- (d) Define Poisson distribution. State its mean and variance. Give one real life situation where Poisson distribution is applied.
- (e) The probability of a successful launching of a rocket is 0.7. Find the probability that,
- (i) For the first time a successful launching will be made on the 5th attempt.
 - (ii) Fewer than 3 attempts will be required to make a successful launching.
- (f) Verify which of the following functions are probability density functions (p. d. f) :
- (i) $f(x) = 4x^3, 0 \leq x \leq 1$
 $= 0$, otherwise
 - (ii) $f(x) = 2e^{-x}, x \geq 0$
 $= 0$, otherwise

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

[16]

- (a) State any **four** properties of distribution function of a continuous random variable.
- (b) Define exponential distribution. State its mean and variance.
- (c) The amount of time that a computer will work without having to be reset is a random variable having an exponential distribution with mean 120 hours. Find the probability that such a computer will,
- (i) have to be set in less than 24 hours, and
- (ii) not have to be reset in at least 180 hours.
- (d) The probability density function of a continuous random variable X is :

$$f(x) = c \cdot \exp \left\{ -\frac{1}{24} (x^2 - 6x + 9) \right\}, \quad c > 0 \quad -\infty < x < \infty$$

Identify the distribution of X and hence, find $P(X > 4)$.

- (e) If X and Y are independent random variables having $N(1, 4)$ and $N(2, 4)$ respectively, state the probability density function (p. d. f.) of $X + y$ and hence find $P(X + Y < 2)$.

- (f) Twenty years ago, entering male high school students of Central High School could do an average of 24 pushups in 60 seconds. To see whether this remains true today, a random sample of 36 freshmen was chosen. If their average was 22.5 with a sample standard deviation of 3.1, test whether the mean pushups in 60 seconds is 24. Use the 5% level of significance.

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

[16]

- (a) Define the following terms :

- (i) Population
- (ii) Statistic
- (iii) Null hypothesis
- (iv) Critical region

- (b) The following information is collected on two characters :

	Cinegoers	Non-cinegoers
Literate	83	57
Illiterate	45	65

Based on this information can you conclude that there is no association between habit of watching cinema going and literacy? Use 5% level of significance.

- (c) Explain the procedure of testing $H_0 : P = P_0$ against $H_1 : P \neq P_0$ for a large sample n , ($n > 30$) at $\lambda\%$ level of significance.
- (d) A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure :

5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4 and 6

Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure? Use 5% level of significance.

- (e) Given below is a sample on 10 lengths of rods (cm) produced on a lathe machine. The population median length is claimed to be 0.5. Test this claim using a sign test at 5% level of significance.

Data : 0.37, 0.62, 0.47, 0.52, 0.64, 0.43, 0.82, 0.68, 0.35, 0.42

- (f) Explain run test used for testing randomness of a sequence of numbers.

