

Total No. of Questions—5]

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[4918]-1001

F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

COMPUTER SCIENCE

Paper I

**CS-101 : Problem Solving Using Computers and 'C' Programming
(2013 PATTERN)**

Time : Three Hours

Maximum Marks : 80

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

(ii) Figures to the right indicate full marks.

1. Attempt *all* of the following : [10×1=10]

- (a) State *one* advantage of assembly language.
- (b) Why is 'C' language called middle level ?
- (c) State the difference between compiler and interpreter.
- (d) Write the use of size of operator.
- (e) Define array.
- (f) What is a pointer ?
- (g) 'A function can return multiple values.' Comment.
- (h) What is the use of • operator ?
- (i) What is a macro ?
- (j) State the use of ftell() function.

P.T.O.

2. Attempt any *four* of the following : [4×5=20]

- (a) Explain the basic data types in 'C'.
- (b) Explain the switch-case statement with suitable example.
- (c) What is a structure ? Give the differences between structure and union.
- (d) Explain with example row and column major representation of two-dimensional array.
- (e) What is a function ? Explain how it is declared and defined. Give example.

3. Attempt any *four* of the following : [4×5=20]

- (a) Write an algorithm and draw a flowchart to check if a number is prime.
- (b) Write a program using recursive function to find factorial of a number.
- (c) Find and correct errors in the following program :

```
#include <stdio.h>
void main( )
{
    int a[n];
    printf("How many numbers:");
    scanf("%d",&n);
    for(i = 0; i <= n; i++)
        scanf("%f",&a[i]);
}
```

(d) What is the output of the following program ?

```
void main( )
{
    char str[ ] = "program";
    char *ptr = str;
    printf("%c%c", *ptr, *ptr + 4);
    ptr = ptr + 3;
    printf("%c%c", *ptr, *(ptr + 2));
}
```

(e) Write the output of the following program and justify :

```
int change(int x, int * y)
{
    x = x + 5;
    *y = *y + 5;
}
main( )
{
    int a = 10, b = 20;
    change(a,&b);
    printf("%d%d", a, b);
}
```

4. Attempt any *four* of the following : [4×5=20]

(a) Write a program to display the following pattern (*n* lines) :

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

- (b) Write a program to find the sum of all elements of a matrix.
- (c) Write a program to accept student information using structure (roll number, name, percentage) for n students. Display student details having highest percentage.
- (d) Write a program to copy the contents of one text file to another.
- (e) Write a menu driven program using string library functions for :
 - (i) length of string
 - (ii) comparing two strings.

5. Attempt any *two* of the following : [2×5=10]

- (a) What are command line arguments ? How are they declared ?
Give the advantages of command line arguments.
- (b) Explain the following :
 - (i) break and continue
 - (ii) static storage class.
- (c) Explain bitwise operators in 'C' with examples.

Total No. of Questions—5]

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[4918]-1002

F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

COMPUTER SCIENCE

Paper II

(CS : 102—File Organization and Fundamentals of Databases)

(2013 PATTERN)

Time : Three Hours

Maximum Marks : 80

- N.B. :-**
- (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.

- 1.** Answer *all* of the following : [10]
- (a) Define DDL and DML.
 - (b) What is a logical file ?
 - (c) Define an Entity.
 - (d) What is a prime attribute ?
 - (e) State the Entity Integrity Constraint.
 - (f) What do you mean by domain of an attribute ?
 - (g) What is a functional dependency ?
 - (h) Give syntax and example of 'Intersection' relational operator.
 - (i) What is SQL ?
 - (j) Justify true or false—'Primary key cannot be null.'

P.T.O.

2. Answer any *four* of the following : [20]

- (a) State and explain the different levels of abstraction.
- (b) Explain aggregation with example.
- (c) What are the different anomalies caused by redundant storage ? Explain any *two* in detail.
- (d) Consider the relation : R(A, B, C, D, E, F) and a set of FD's on R as :
$$F = \{A \rightarrow C, C \rightarrow BE, E \rightarrow F, CD \rightarrow F, E \rightarrow D\}$$
Compute closure of F i.e. F^+ .
- (e) Explain any *two* types of file organizations.

3. Answer any *four* of the following : [20]

- (a) Explain the advantages of DBMS over traditional file system.
- (b) What are mapping cardinalities ? Explain any *two* in detail.
- (c) What are the different functions performed by DBA ?
- (d) What is an attribute ? State different types of attributes and explain any *two* in detail.
- (e) State rules of conversion of an Entity Relationship diagram into relational tables.

4. (A) Answer any *three* of the following : [15]

(a) Consider the following relations :

Employee (e_no, ename, address, salary)

Department (d_no, dname, assets)

Employee and Department are related with many to one relationship. Create a RDB and solve the following queries in SQL :

(i) List all the employees belonging to the 'Production' department.

(ii) Give the names and salaries of all employees working in the departments having assets greater than 2,00,000.

(iii) Find the names of departments where more than 30 employees are working.

(b) Consider the following relations :

Student (s_no, name, class, age)

IQtest(t_no, tname, t_type, t_equipment, level)

Student and IQ test are related with many to many relationship, with the descriptive attribute score. Create a RDB and solve the following queries in SQL :

(i) Give the name of the student who has scored maximum marks in 'Cognitive Assessment' test.

- (ii) List the distinct types of IQ test available.
- (iii) List studentwise test and score for all students of age 5.
- (c) Consider the following relations :
- Project (p_no, pname, location, budget)
- member (m_no, name, department, specialization)
- Project and member are related with many to many relationship. Create a RDB and solve the following queries in SQL :
- (i) List all the members working on 'ACM development' project.
- (ii) Count the no. of projects located in 'Kothrud'.
- (iii) Give name of the project with minimum budget.
- (d) Consider the following relations :
- Dancer (d_no, name, age, phone_no.)
- Dance_form (f_no, name, state-of-origin)
- Dancer and Dance_form are related with many to many relationship. Create a RDB and solve the following queries in SQL.
- (i) Find names of dancers who know the dance form 'Bharatnatyam'.
- (ii) Count the no. of dance forms which have originated in the state of Karnataka.
- (iii) Give the names of dancers who know more than one dance form.

(B) Answer any *one* of the following : [5]

(a) Consider the following relations :

Boat (b_id, b_name, colour)

Sailor (s_id, s_name, address, age)

Boat_sailor (s_id, b_id, date-of-booking)

Solve the following queries in relational algebra :

(i) Find all sailors whose age is greater than 60.

(ii) Give details of all sailors who have booked red boats.

(iii) Give sailor name and address of all sailors who have booked a boat on '01-01-2010'.

(iv) Give the names of sailors who have booked red as well as green boats.

(v) Give the details of all boats booked by the sailor 'Raju'.

(b) Consider the following relations :

Food-Item (f_id, f_name, type, rate)

Customer (c_id, name, phone_no, address)

Cust_food (c_id, f_id, quantity, table_no, date)

Solve the following queries in Relational Algebra :

(i) Find the list of food items of the type 'vegetarian'.

- (ii) Give the names and quantity of food items ordered by the customer 'Ms. Swapna'.
- (iii) Find the names of all customers who have ordered the food item 'Crunchy Vegetables'.
- (iv) Find the customers who have ordered some vegetarian dishes and some non-veg. dishes.
- (v) Give names of all customers who ordered some food item on the date '29-05-2015'.

5. (A) A small business firm wants to develop an application that will keep track of its employees, their positions, allowances, salary scales and which vehicles are assigned to the employees. The firm has a fixed number of positions. Each employee works on a particular position, and there may be several employees working at one position. Each position has a fixed amount of allowances and salary scale.

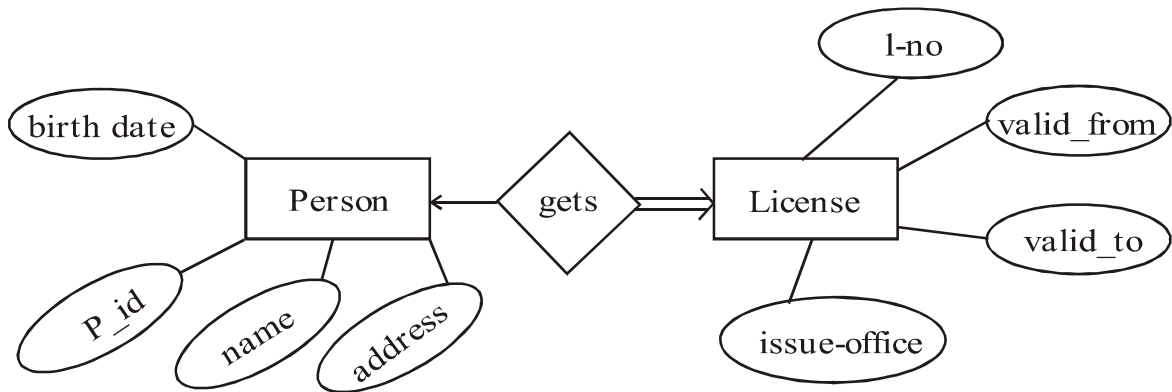
The firm also has a number of vehicles, which are allocated to the employees. They need to keep track of the vehical type, vehical licence no, date of purchase and the date on which the vehical is issued to some employee.

- (i) Design an E-R diagram for the above scenario, assume attributes if necessary.
- (ii) Convert the E-R diagram into a relational database in 3NF. [7]

- (B) Explain with example the difference between weak entity set and strong entity set. [3]

Or

Consider the following ER diagram :



Convert the above E-R diagram into relational model.

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[4918]-1003

F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

MATHEMATICS

Paper I

MTC-101 : Discrete Mathematics

(2013 PATTERN)

Time : Three Hours

Maximum Marks : 80

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

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

1. Attempt any *eight* of the following : [16]

(1) Translate into symbolic form :

(a) All juniors are clever.

(b) Some men do not like cats.

(2) Let A and B be 2 sets. Suppose $|A| = 3$ and $|B| = 4$.

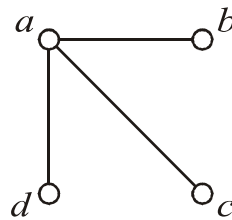
Find number of functions from A to B.

(3) Define Particular solution and total solution of non-homogenous recurrence relation.

(4) Define Complemented lattice.

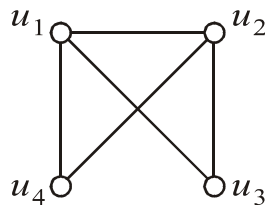
P.T.O.

- (5) Determine the truth set of the following proposition over positive integers :
- (a) $p(n) = n$ is perfect square and $n < 100$.
- (b) $q(n) = n$ is prime and $n < 25$.
- (6) Define Simple symmetric digraph and complete digraph.
- (7) Find complement of the following graph G :



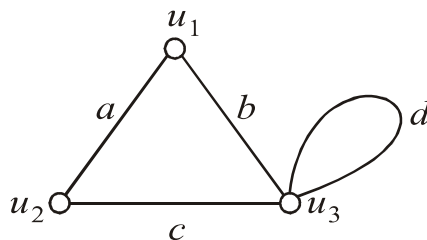
G

- (8) Define Isthmus. Give *one* example.
- (9) Write down adjacency matrix for the following graph :



G

- (10) Explain Handshaking lemma. Verify it for the following graph :



2. Attempt any *four* of the following :

[16]

(1) Test the validity of the following argument :

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

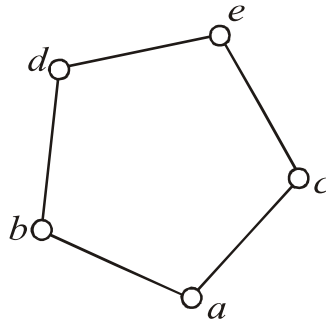
(2) Solve :

$$a_r + 6a_{r-1} + 12a_{r-2} + 8a_{r-3} = 0$$

where $a_0 = 0, a_1 = 2, a_2 = 8.$

(3) How many integers between 1 and 1000 are divisible by 2 or 5 or 7 ?

(4) Define Distributive lattice. Is the following lattice distributive ? Justify.



(5) Show that $p \rightarrow (q \rightarrow r)$ and $p \rightarrow (\sim q \vee r)$ are logically equivalent.

(6) Find the number of ways to select ' r ' balls from 3 red balls and 2 white balls and 3 green balls.

3. Attempt any *two* of the following : [16]

(1) Solve :

$$a_r - 5a_{r-1} + 6a_{r-2} = 2^r + r, \quad a_0 = 1, \quad a_1 = 1.$$

(2) Draw Hasse diagram for D_{30} = positive divisors of 30 with the partial order 'divides'. Find maximal and minimal element. Also find complement of each element. List the atoms of this lattice.

(3) (a) Give direct proof for :

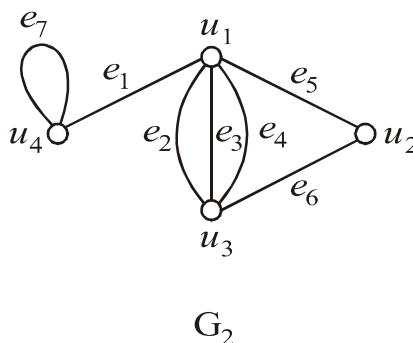
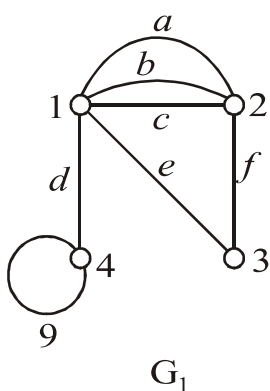
$$p, p \rightarrow q, s \vee r, r \rightarrow \sim q \vdash s \vee t.$$

(b) Give indirect proof for :

$$\sim p \vee q, s \vee p, \sim q \vdash s.$$

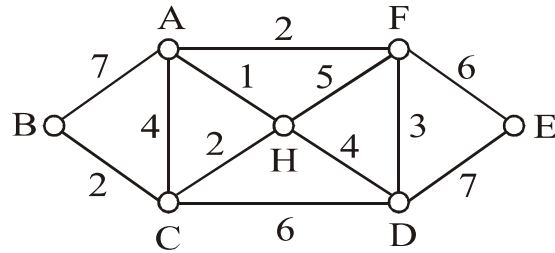
4. Attempt any *four* of the following : [16]

(1) Show that the following 2 graphs (G_1 and G_2) are isomorphic :

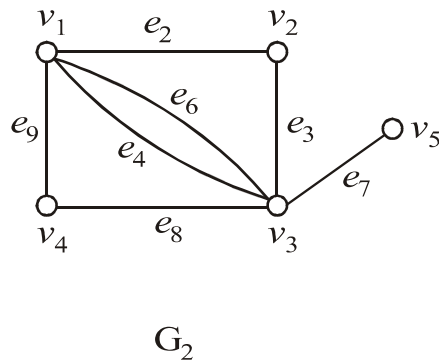
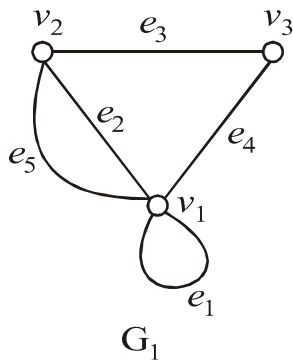


(2) Prove that a connected graph G is an Euler graph iff the degree of every vertex is even.

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



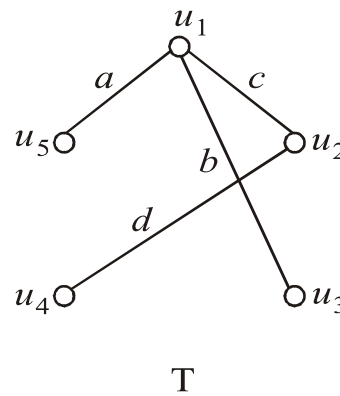
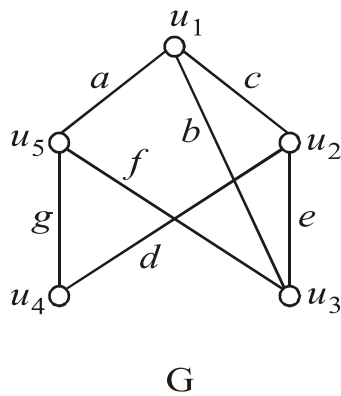
- (4) Find $G_1 \cup G_2$ and $G_1 \oplus G_2$ of the following graphs :



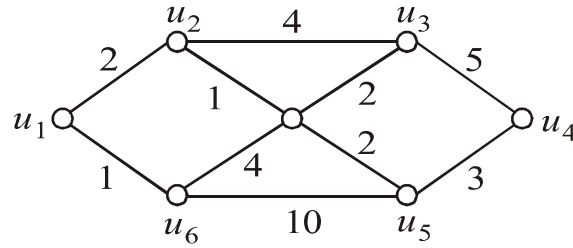
- (5) Prove that every tree has one or two adjacent centres.
 (6) Explain Fleury's algorithm. Give *one* example.

5. Attempt any *two* of the following : [16]

- (1) Find all fundamental circuits and fundamental cutsets for G with respect to spanning tree T :



- (2) Using Dijkstra's algorithm find the shortest path between u_1 and u_4 .



- (3) Prove that if G is simple graph with n vertices m edges and k components then :

$$m \leq (n - k) (n - k + 1)/2.$$

Total No. of Questions—5]

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[4918]-1004

F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

MATHEMATICS

Paper II

MTC-102 : Algebra and Calculus

(2013 PATTERN)

Time : Three Hours

Maximum Marks : 80

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

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of non-programmable scientific calculator is allowed.

1. Attempt any *eight* of the following : [8×2=16]

(1) Define symmetric relation. Give *one* example.

(2) Draw digraph for the following relation :

$$R = \{(1, 2), (2, 3), (3, 2), (3, 3)\}.$$

(3) State first principle of mathematical induction.

(4) Define Euler's ϕ function. Find $\phi(100)$.

(5) Consider the set

$$A = \{1, -1, i, -i\}$$

with usual multiplication. Write inverse of each element.

P.T.O.

- (6) State true or false with justification. 'Every continuous function is differentiable'.
- (7) Find n th derivative of a^{mx} .
- (8) If order of the matrix A is 3×5 , then what are the possible maximum values of row rank and column rank for A.
- (9) Test whether the following matrix is in reduced row echelon form. Justify :

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

- (10) State Taylor's theorem with Lagrange's form of remainder.

2. Attempt any *four* of the following : [4×4=16]

- (1) Let R be the relation

$$\{(1, 2), (1, 3), (2, 3), (2, 4), (3, 1)\}$$

and S be the relation

$$\{(2, 1), (3, 1), (3, 2), (4, 2)\}$$

Find the composite relation $S \circ R$ on the set

$$A = \{1, 2, 3, 4\}.$$

- (2) Express the following permutation on S_9 as a product of disjoint cycles and hence find order of σ .

$$\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 2 & 1 & 4 & 3 & 6 & 7 & 5 & 9 & 8 \end{pmatrix}.$$

Also determine whether σ is even or odd.

(3) Find the remainder of 3^{97} when divided by 31.

(4) If

$$a \equiv b \pmod{n}, c \equiv d \pmod{n},$$

then prove that :

(i) $(a + c) \equiv (b + d) \pmod{n}$

(ii) $ac \equiv bd \pmod{n}$

(5) Using Warshall's algorithm, obtain transitive closure of the following relation :

$$R = \{(1, 2), (2, 2), (2, 4), (3, 2), (3, 4), (4, 1)\}$$

(6) Write composition table for $(\mathbf{Z}_6, +)$. Is it a cyclic group ?
If yes, write all generators.

3. Attempt any *two* of the following : [2×8=16]

(1) Let \sim be an equivalence relation on a non-empty set A, then prove that :

(i) $a \in [a], \forall a \in A$

(ii) Any *two* equivalence classes are either disjoint or identical.

(2) Show that the set :

$$G = \left\{ \begin{bmatrix} x & x \\ x & x \end{bmatrix} \middle/ x \neq 0, x \in \mathbf{R} \right\}$$

is an abelian group under usual matrix multiplication.

- (3) Find greatest common divisor (gcd) of 7260 and 1638. Express it in the form $7260m + 1638n$ where m and n are integers.

4. Attempt any *four* of the following : [4×4=16]

- (1) Expand :

$$x^4 - 5x^3 + x^2 - 3x + 4$$

in powers of $(x - 1)$.

- (2) Solve the following linear system by Gauss elimination method :

$$x - y + z = 5$$

$$9x + 3y + z = 1$$

$$x + y + z = -1.$$

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

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

- (4) Evaluate :

$$\lim_{x \rightarrow 1} \left(\frac{1}{x-1} - \frac{1}{\log x} \right).$$

- (5) Apply Rolle's theorem to the function :

$$f(x) = (4 - x) \log x$$

and show that

$$c \log c = 4 - c$$

for some $c \in (1, 4)$.

(6) Assuming validity of expansion, prove that :

$$\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \dots .$$

5. Attempt any *two* of the following : [2×8=16]

(1) State Leibnitz's theorem for the n th derivative of product of two functions.

If

$$y = e^{\tan^{-1}x}$$

then show that :

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

(2) (i) State and prove Lagrange's mean value theorem.

(ii) Verify Lagrange's mean value theorem and find C if possible for the function :

$$f(x) = x - x^3$$

on $[-2, 1]$.

(3) Using LU decomposition, solve the following system :

$$\begin{bmatrix} 3 & -6 & -3 \\ 2 & 0 & 6 \\ -4 & 7 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -3 \\ -22 \\ 3 \end{bmatrix} .$$

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**F.Y. B.Sc. (Computer Science) EXAMINATION, 2016
ELECTRONICS SCIENCE**

Paper I

**ELC-101 : Principles of Analog Electronics
(2013 PATTERN)**

Time : Three Hours

Maximum Marks : 80

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

1. Attempt *all* of the following : [8×2=16]
- (a) Define the term capacitive reactance.
 - (b) Draw the circuit symbols for LED and Zener diode.
 - (c) Define intrinsic stand off ratio for UJT.
 - (d) Draw the circuit diagram for non-inverting amplifier.
 - (e) For a transistor $\alpha = 0.96$, find the value of β .
 - (f) State superposition theorem.
 - (g) Find the voltage across each resistor in the following circuit
Fig. 1 :

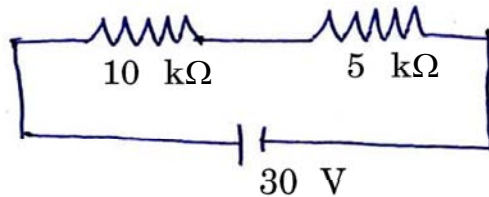


Fig. 1

- (h) Explain the concept of Bandwidth for amplifier.

P.T.O.

2. Attempt any *four* of the following : [4×4=16]

(a) Using Thevenin's theorem, find current through R_L in the following circuit Fig. 2 :

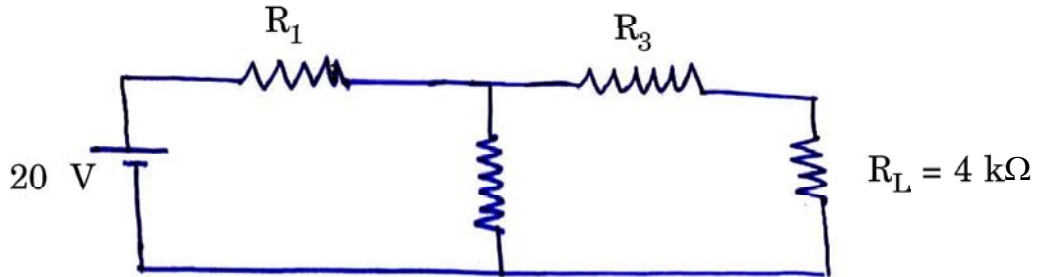


Fig. 2

- (b) Explain the action of diode as clipper.
- (c) Compare BJT and FET.
- (d) Draw the circuit diagram for Op Amp as adder. Derive the expression for its output voltage.
- (e) Explain classification of resistors.
- (f) Explain how transistor is used as switch.

3. Attempt any *four* of the following : [4×4=16]

(a) Draw the block diagram of regulated power supply and explain each block.

(b) Draw the Norton's equivalent circuit for the following circuit Fig. 3 :

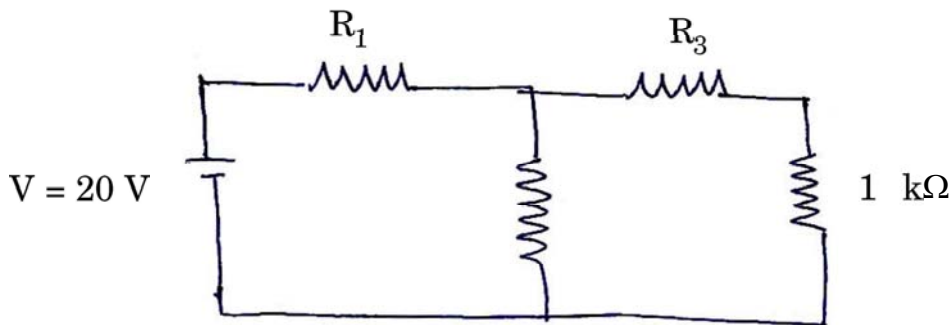


Fig. 3

- (c) Draw the DC load line for the given circuit (Fig. 4) :

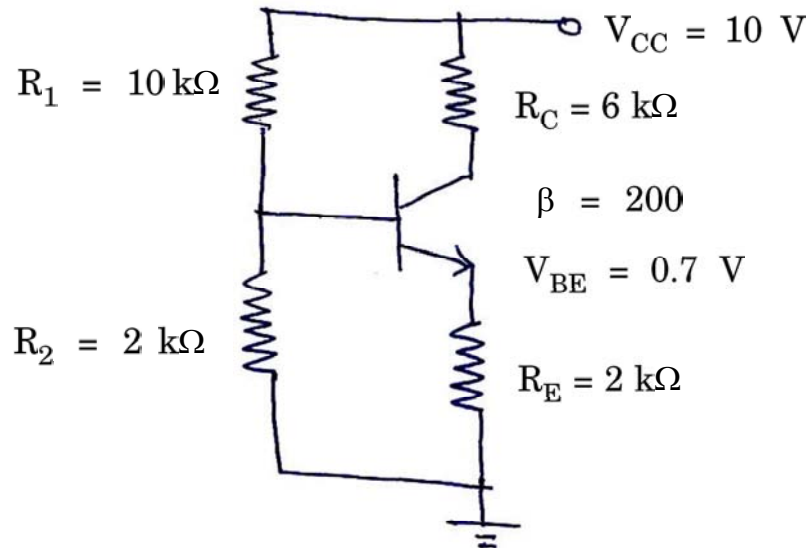


Fig. 4

- (d) Define the following parameters of FET :

- (i) Dynamic drain resistance
- (ii) Transconductance
- (iii) Amplification factor

Derive the relation between them.

- (e) Explain the working principle of relay.
- (f) Draw the circuit diagram for inverting amplifier and explain virtual ground.

4. Attempt any *four* of the following : [4×4=16]

- (a) State different types of cables and connectors.
- (b) Explain the working of series LCR circuit.

- (c) Draw the circuit diagram for single stage RC coupled CE amplifier. Explain the role of coupling and bypass capacitor in it.
- (d) Explain working principle of optocoupler.
- (e) With the help of graph explain the working of UJT.
- (f) Define the following parameters for Op Amp :
 - (i) Slew rate
 - (ii) Input bias current
 - (iii) Output offset voltage
 - (iv) CMRR

5. Attempt any *two* of the following : [2×8=16]

- (a) (I) Determine the colour code for resistors :
 - (i) $100 \text{ k}\Omega \pm 10\%$
 - (ii) $4.7 \text{ k}\Omega \pm 5\%$
- (II) State Kirchhoff's laws. Find the values of currents flowing through both resistors in the circuit given below (Fig. 5):

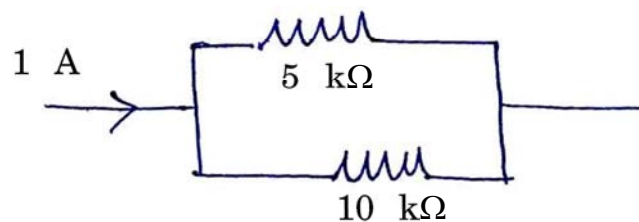


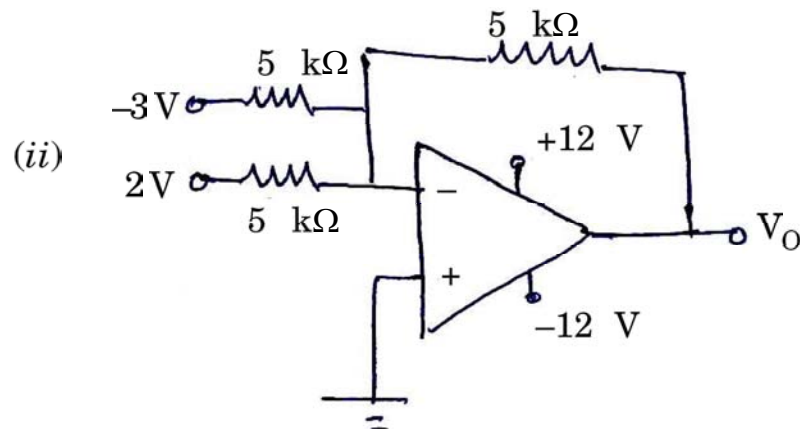
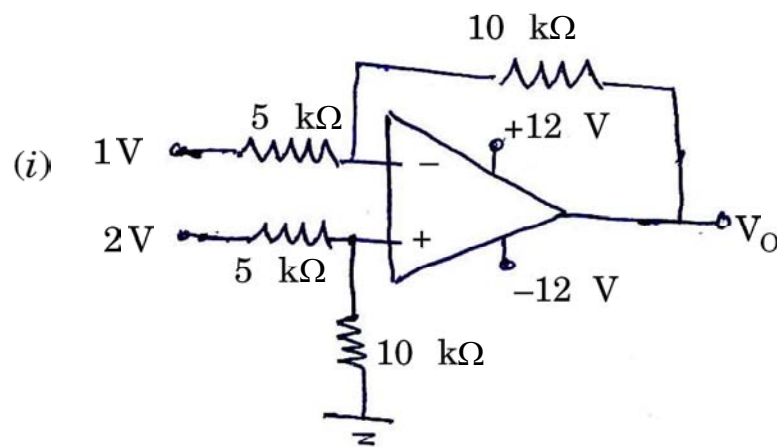
Fig. 5

- (b) (I) (i) Draw the circuit diagram for RC low pass filter.
- (ii) Compare half wave and full wave rectifier.
- (II) What is biasing ? Explain the factors affecting the stability of Q point in transistor ?

(c) (I) (i) State different types of transistor configurations. Which one is widely used.

(ii) In a JFET circuit, $\Delta I_D = 10 \text{ mA}$ and $\Delta V_{GS} = 2 \text{ V}$. Determine the value of transconductance.

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



Total No. of Questions—4]

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[4918]-1006

F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

ELECTRONICS SCIENCE

Paper II

(Principles of Digital Electronics)

(2013 PATTERN)

Time : Three Hours

Maximum Marks : 80

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

(ii) Neat diagram must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

1. Attempt *All* of the following :

[8×2=16]

(a) Write the full form of ASCII.

(b) Define Minterm.

(c) Perform $(11010)_2 - (1100)_2$ using rules of binary subtraction.

(d) Define decoder.

(e) Find number of flip-flops required for MOD-90 counter.

(f) Draw the symbol of tri-state inverter and mention the use of enable pin.

(g) Give any *two* applications of demultiplexer.

(h) What do you understand by edge triggering in flip-flops ?

P.T.O.

2. Attempt any *four* of the following : [4×4=16]

(a) Perform :

(i) $(186.325)_{10} = (?)_2$

(ii) $(358.23)_{10} = (?)_{16}$.

(b) Convert NOR gate into OR and AND gate.

(c) Perform $(10101)_2 - (0011)_2$ using is complement and 2's complement method.

(d) Describe the working of 1 : 2 Demultiplexer.

(e) Explain the working of J.K. flip-flop using NAND gates.

(f) Explain the following terms :

(i) Propagation delay

(ii) Logic levels

(iii) Fan-out

(iv) Noise immunity.

3. Attempt any *four* of the following : [4×4=16]

(a) Convert :

(i) $(678)_{\text{excess-3}} = (?)_{10}$

(ii) $(011010011000)_{\text{BCD}} = (?)_{10}$.

(b) Draw the circuit diagram of Half adder and Half subtractor and write truth tables of both.

- (c) Convert the given SOP expression into standard SOP form :

$$Y = A + B\bar{C}.$$

- (d) What are the types of seven segment display ? Give the seven segment code for displaying decimal digit 3 using them.
- (e) Explain the working of 3-bit ring counter.
- (f) Explain working of *two* input TTL NAND gate.

4. Attempt any *four* of the following : [4×4=16]

- (a) Convert :

(i) $(101010)_2 = (?)_{\text{Gray}}$

(ii) $(001100)_{\text{Gray}} = (?)_2.$

- (b) Simplify the following expression using rules of Boolean algebra :

$$Y = (\overline{AB} + C) (\overline{A + B}).$$

- (c) (i) Find the time required to shift 4-bit data through a 4-bit PISO shift register if the clock frequency is 1 MHz.
- (ii) Determine the number of control lines for a multiplexer having 64 inputs.
- (d) What is meant by derived gate ? Draw the symbol of any *two* derived gates with their Boolean expression.

- (e) Draw the K-map for the given truth-table and simplify it :

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

- (f) (i) List any *two* problems faced while handling CMOS devices.
- (ii) What is ALU ? Why is it required ?

5. Attempt any *two* of the following : [2×8=16]

- (a) Explain the working of 3-bit asynchronous up counter. Draw the timing diagram.
- (b) Explain the working of 4-bit universal adder/subtractor. How many half adders and full adders are required for 8-bit addition ?
- (c) Draw and explain the working of Decimal to Binary Converter.

Total No. of Questions—5]

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[4918]-1007

F.Y.B.Sc. (Computer Science) EXAMINATION, 2016

STATISTICS

Paper I

(Statistical Methods-I)

(2013 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 non-programmable, scientific calculator and statistical tables is allowed.

(iv) Symbols have their usual meaning unless otherwise stated.

1. (a) Attempt each of the following : [1 mark each]

(i) For plotting histogram for an exclusive grouped frequency distribution,.....are plotted on X axis.

(ii) The mean of the Binomial distribution is.....than its variance.

P.T.O.

- (iii) If the correlation between the variable X and Y is 0.5 then the correlation between the variables X and and (-Y) is..... .
- (iv) If the mean and variance of a data set are 7 and 7 respectively then coefficient of variation is..... .
- (b) Attempt each of the following : [1 mark each]
- (i) In exclusive type classes, the limits excluded are :
- (a) class mark
 - (b) either of the lower *or* upper limit
 - (c) frequency
 - (d) lower and upper limits both
- (ii) In case of positive skewed distribution, the relation between mean, median and mode is :
- (a) median > mean > mode
 - (b) median = mean = mode
 - (c) median < mean < mode
 - (d) mean > median > mode
- (iii) The first central moment of a data set is :
- (a) 1
 - (b) mean
 - (c) 0
 - (d) any value.

(iv) Two lines of regression intersect at the point :

(a) (\bar{X}, \bar{Y})

(b) (X, Y)

(c) $(0, 0)$

(d) $(1, 1)$

(c) Attempt each of the following : (2 marks each)

(i) State additive property of a Poisson distribution.

(ii) Comment on the validity of statement : The two regression coefficients are -2 and -0.056 and the coefficient of correlation is -0.112 .

(iii) A random variable X assumes 3 values $-1, 0, 1$ with probabilities $1/3, 1/6, 1/2$ respectively. Find the probability mass function of $Y = 2X - 3$.

(iv) State multiplicative model of time series.

2. Attempt any *four* of the following : [4 marks each]

(a) Define arithmetic mean for a grouped frequency distribution. State merits of mean as a measure of central tendency.

(b) For the following frequency distribution, find the median and third quartile :

Class Interval	Frequency
30—32	2
32—34	9
34—36	25
36—38	37
38—40	17

- (c) Explain the following terms with an example :
- (i) inclusive class interval
- (ii) more than cumulative frequency
- (d) The data about number of wickets taken by two bowlers A and B in a year is as follows :

	Player A	Player B
Mean	53	45
S.D.	40	16

Examine :

- (i) Which player is more consistent ?
- (ii) Which player is better in average ?
- (e) State a measure of dispersion. Distinguish between absolute and relative measures of dispersion.
- (f) Find the mean and variance of 1st 'n' natural numbers.

3. Attempt any *four* of the following : [4 marks each]

- (a) What is kurtosis ? How the extent of kurtosis is related with dispersion of the data set ?
- (b) For a grouped frequency distribution mean, coefficient of variation and Karl Pearson's coefficient of skewness are 40, 45% and -0.5 respectively. Find the standard deviation, mode and median.
- (c) Define cumulative distribution function (*c.d.f.*) of a discrete random variable. State any *two* properties of *c.d.f.*
- (d) If X represents the total number of heads obtained, when a fair coin is tossed 3 times.

Find :

- (i) the probability distribution of X .
- (ii) Mean of X .
- (iii) Median of X .
- (e) Define Poisson distribution with parameter λ . Also, state Poisson approximation to binomial distribution.
- (f) If X has the distribution function :

$$F(X) = \begin{cases} 0 & , X < -1 \\ \frac{1}{4} & , -1 \leq X < 1 \\ \frac{1}{2} & , 1 \leq X < 3 \\ \frac{3}{4} & , 3 \leq X < 5 \\ 1 & , X \geq 5 \end{cases}$$

Find :

- (i) Probability mass function of X .
- (ii) $P(-0.4 < X < 4)$
- (iii) $P(X = 5)$.

4. Attempt any *two* of the following : [8 marks each]

(a) (i) If $n = 50$, $\Sigma X = 75$, $\Sigma Y = 80$, $\Sigma X^2 = 130$, $\Sigma Y^2 = 140$, $\Sigma XY = 120$, find the value of Karl Pearson's coefficient of correlation between X and Y and interpret its value.

(ii) Explain stem and leaf chart with an example.

(b) (i) State similarities and differences between correlation and regression for a bivariate data.

(ii) Suppose $X \sim B(n, p)$. If $E(X) = 5$ and $V(X) = 2.5$, find the values of n and p . Also find $p(x \leq 1)$.

(c) (i) The two regression lines between amount of rainfall (X) in cm and temperature (Y) in °C are

$$4y - 15x + 530 = 0 \text{ and } 20x - 3y - 975 = 0.$$

Find the mean amount of rainfall and mean temperature.

Also estimate the temperature when the amount of rainfall is 80 cm.

(ii) Product produced by a machine has 3% defective rate. What is the probability that the first defective occurs in the fifth item inspected? Also find the expected number of defectives produced by a machine.

(d) (i) For a trivariate data, $r_{12} = r_{23} = r_{13} = 0.3$. Find the values of $r_{13.2}$ and $R_{1.23}$.

(ii) Write a note on Auto-regressive model of order -1.

5. Attempt any *one* of the following : [16 marks]

(a) (i) The first four raw moments of a distribution are 2, 5, 12 and 48. Find the values of first four central moments. Also find the coefficient of skewness and kurtosis based upon moments and interpret their values.

(ii) Write the stepwise procedure of fitting the curve $Y = a + bX + cX^2$ using the method of least square.

(b) (i) X_1, X_2, X_3 are the variable measured from their means and following data is given.

$$r_{12} = 0.28 \quad r_{13} = 0.5 \quad r_{23} = 0.49$$

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

Obtain the equation of plane of regression of X_2 on X_1 and X_3 and estimate X_2 when $X_1 = 1$ and $X_3 = 11$. Also, find $R_{2.13}$.

(ii) Find the centered 4 yearly moving average from the following time series :

Years	Sales (Rs '00)
2000	15
2001	20
2002	18
2003	17

2004	17
2005	26
2006	25
2007	22
2008	20
2009	29
2010	27
2011	24

Total No. of Questions—5]

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F.Y. B.Sc. (Computer Science) EXAMINATION, 2016

STATISTICS

Paper II

(Statistical Methods—II)

(2013 PATTERN)

Time : Three Hours

Maximum Marks : 80

- N.B. :—**
- (i) All questions are compulsory.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of non-programmable, scientific calculators and statistical tables is allowed.
 - (v) Symbols have their usual meanings unless otherwise stated.

1. Attempt each of the following :

- (a) Fill in the blanks : [1 each]
- (i) If two events A and B are independent, then $P(A \cup B) = \dots\dots\dots$.
 - (ii) Every subset of a sample space is known as an $\dots\dots\dots$.
 - (iii) The mean of continuous uniform distribution with parameters a and b is $\dots\dots\dots$.
 - (iv) The probability of type I error is called as $\dots\dots\dots$.

P.T.O.

(b) Select *correct* option for each of the following : [1 each]

(i) The probability of an impossible event is :

(a) 1

(b) $1 - P(\phi)$

(c) $P(\Omega)$

(d) 0

(ii) If A and B are mutually exclusive events defined on a sample space Ω such that $P(A) = 3/8$, $P(B) = \frac{1}{2}$, then

$P(A \cup B)$ is :

(a) $5/8$

(b) $8/5$

(c) $7/8$

(d) $11/16$

(iii) For a continuous random variable X, if $E(X) = \frac{7}{3}$, then

$E(4X + 3)$ is :

(a) $\frac{7}{3}$

(b) $\frac{28}{3}$

(c) $\frac{31}{3}$

(d) $\frac{37}{3}$

(iv) For a large sample, the critical region for testing $H_0 : P = P_0$ against $H_1 : P < P_0$ at $\alpha\%$ l.o.s. :

(a) $c = \{z \mid z > z_\alpha\}$

(b) $c = \{z \mid z < -z_\alpha\}$

(c) $c = \{z \mid z < z_\alpha\}$

(d) $c = \{z \mid |z| > z_{\alpha/2}\}$

(c) Attempt each of the following : [2 each]

(i) For the experiment "a die is tossed until it shows Six for the first time". Write the sample space and state the type of sample space.

(ii) If X is a continuous random variable with probability density function (p.d.f.) :

$$f(x) = kx^2, \quad 0 < x < 3$$
$$= 0, \quad \text{otherwise}$$

Find value of k .

(iii) State lack of memory property of an exponential distribution with mean θ .

(iv) Define simulation. State *one* advantage of simulation.

2. Attempt any *four* of the following : [4×4]

(a) Define permutation. Also, state the formulae for total number of permutations of objects when :

(i) all are distinct, and

(ii) not all distinct.

- (b) The letters of the word 'READING' are arranged at random. Find the probability that :
- (i) the vowels occupy the even place,
 - (ii) vowels come together.
- (c) State the axioms of probability. Hence, prove the following :
"For any event A defined on the sample space Ω , $0 \leq P(A) \leq 1$."
- (d) A lot consists of 10 good keyboards, 4 with minor defects and 2 with major defects. Two keyboards are chosen from the lot at random without replacement. Find the probability that :
- (i) Both are good
 - (ii) At least one is good.
- (e) Define each of the following with an illustration :
- (i) Complement of an event
 - (ii) Mutually exclusive events.
- (f) Four cards are drawn at random from a pack of 52 playing cards. Find the probability that :
- (i) they are clubs
 - (ii) they are a king, a queen, a jack and an ace.

3. Attempt any *four* of the following : [4×4]

- (a) Explain each of the following :
- (i) Non-deterministic model
 - (ii) Probability density function of a continuous type r.v. X.

(b) Given that :

$$P(A_1) = \frac{4}{9}, P(A_2) = \frac{2}{3} \text{ and } P(A_3) = \frac{1}{3}$$

$$P(B/A_1) = \frac{3}{10}, P(B/A_2) = \frac{1}{2} \text{ and } P(B/A_3) = \frac{4}{5}.$$

Find :

(i) $P(B)$

(ii) $P(A_1/B)$.

(c) Define each of the following :

(i) Conditional probability of an event

(ii) Partition of sample space

(iii) Sensitivity of a test

(iv) Continuous random variable.

(d) A random variable X has the p.d.f. $f(x)$ defined as :

$$f(x) = \begin{cases} \frac{1}{12}(x+3) & , \quad -2 \leq x \leq 2 \\ 0 & , \quad \text{otherwise} \end{cases}$$

Find :

(i) $E(X)$

(ii) $V(X)$.

(e) Suppose that during rainy season on a tropical island the length of the shower has an exponential distribution, with mean 2, time being measured in minutes. What is the probability that :

(i) a rain shower will last more than 3 minutes

(ii) a rain shower will last between 1 and 4 minutes ?

(f) Define distribution function of a continuous random variable and state its any *two* properties.

4. Attempt any *two* of the following : [2×8]

(a) (i) Define normal distribution. State how Poisson distribution can be approximated by a normal distribution.

(ii) Let X be normally distributed r.v. with mean 80 and standard deviation 16. Find :

(1) $P(X > 100)$

(2) $P(80 < X < 120)$.

(b) (i) Define Pareto distribution. State its mean and variance.

(ii) If r.v. X is uniformly distributed over [1, 2], find 'α' such that $P(X > \alpha + \mu'_1) = 1/4$ where 'α' is a constant.

(c) (i) Describe procedure of sign test.

(ii) The following data is collected on two attributes :

	Cinegoers	Non-Cinegoers
Literate	83	57
Illiterate	45	68

Test at 5% level of significance (l.o.s.), whether literacy is independent of the habit of cinema going.

(d) (i) Describe stepwise test procedure for testing $\mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$ for $n < 30$.

- (ii) The win-lose record of a certain basketball team for their last 25 consecutive games was as follows :

LWWWLLWWWWWLWLLWLLWLLWWW

Test that the sequence of wins and losses is random at 5% l.o.s.

5. Attempt any *one* of the following :

- (a) (i) Define each of the following terms : [4]

Statistic

Sampling distribution of a statistic

Alternative hypothesis

Critical region.

- (ii) In a referendum submitted to the student body at a university, 850 men and 566 women voted. 530 of the men and 304 of the women voted 'yes'. Does this indicate a significant difference of opinion on the matter at 1% l.o.s., between men and women students. [4]

- (iii) A chemical extraction plant processes sea water to collect sodium chloride and magnesium. It is known that sea water contains sodium chloride, magnesium and other elements in the ratio of 62 : 4 : 34. A sample of 200 tonnes of sea water has resulted in 130 tonnes of sodium chloride, 6 tonnes of magnesium and 64 tonnes of other elements. Are these data consistent with the known composition of sea water at 5% l.o.s. ? [8]

- (b) (i) Describe test procedure to test $H_0 : \mu = \mu_0$ against $H_1 : \mu > \mu_0$ for a large sample. [4]
- (ii) Generate model sample of size 4 from normal distribution with mean 35 and variance 25 i.e. $N(\mu = 35, \sigma^2 = 25)$ using Box-Muller transformation. Use random numbers 2519, 2302, 5585, 6845, 1027, 2841, 3421, 6181. [4]
- (iii) The following data represent the body-breadth (x , in cm) and body-weight (y , in gm) of 7 randomly selected sea fishes :

x	y
0.5	10
0.6	15
0.8	25
0.4	12
0.5	15
0.7	14
1	25

Do you think that the body-weight and body-breadth of fishes are significantly correlated ? Use 5% l.o.s. [8]