FEDERAL UNIVERSITY OF ARICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER 2017/2018 UNIVERSITY EXAMINATIONS
CSC217 – DATA STRUCTURES AND ALGORITHMS

Instructions: *Answer **two** questions from each part on a **separate booklet**. Time Allowed: 2½ hours*

PART 1

1. Compare allocation of storage using parameters given in the table below

Operation on Storage	Sequential Storage Allocation	Linked List Storage Allocation
Insertion		
Deletion		
Overflow		
Storage Management		

Use relevant examples in your discussion

2(a) Draw the tree represented by the list $(x(y(q,p),z(t(w),r(k,l,m),s)))$

(b) i Draw the binary tree that stores **28, 15, 9, 24, 14, 70, 13, 49** sorted.

ii What scanning order will reproduce the data in your tree in ascending order?

3. Linked allocation of storage links nodes together by dividing each node into two fields or more.

(a) Using this approach, organize the following data in alphabetic order without moving them in store

Memory Address	Data Item
0011	
0012	Ojo
0013	
0014	Folorunso
0015	Tinubu
0016	
0017	
0018	Abayomi-Ali
0019	
0020	Onasoga
0021	

(b) If you were to insert new items, Salako and Vincent into the list, how would this be done?

(c) What are the two main advantages in the above scheme?

PART 2

(4) Find the value of the following quantities

(i) $\sum_{k=50}^{100} k^2$ (ii) $\sum_{i=0}^{2}\sum_{j=0}^{3}(2i+3j)$ (iii) $\prod_{i=1}^{3}(\prod_{j=1}^{2})$

5(i) Write the quick sort algorithm
(ii) Write the selection algorithm
(iii) Sort the list 3, 2, 4, 5, 1 using an insertion sort

6(a) List all the steps used to search for 9 in the sequence 1, 3, 4, 5, 6, 8, 9, 11 using
(i) Linear search
(ii) Binary search
(b) Write the ternary algorithm

Start = 0
End = n-1

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CSC217 – DATA STRUCTURES AND ALGORITHMS

Instructions: ***Answer four questions in all.*** ***Time Allowed: 2½ hours***

1. Compare allocation of storage using parameters given in the table below

Operation on Storage	Sequential Storage Allocation	Linked List Storage Allocation
Insertion		
Deletion		
Overflow		
Storage Management		

Use relevant examples in your discussion

2(a) Draw the tree represented by the list $(x(y(q,p),z(t(w),r(k,l,m),s)))$

(b) i Develop a recursive algorithm that uses binary tree to sort data in ascending order

ii Using your algorithm, draw the binary tree that stores **28, 5, 92, 73, 41, 0, 13, 100** sorted.

iii What scanning order will reproduce the data in your tree in descending order?

3(a) Represent the expression $x = r * p - (4 + m * q) / (w - a * b)$ with a binary tree

(b) Transverse the tree in NLR order.

(c) Thread the tree for the scanning order in (b).

(d) How will this tree be represented in the computer memory if each node were doubly linked?

4(a) What are the differences between searching and sorting? Put your comparisons in a table

(b) Consider the list of data items $a_1, a_2, a_3, \ldots, a_n$ *such that* $a_i \le a_{i+1} \forall i, i = 1, 2, 3, \ldots, n$

i Develop an efficient search algorithm for data items in the list.

ii Compute the worst case search time for the search algorithm in b (i).

5. Write short notes on the following:

(i) Access table

(ii) Dope vector

(iii)Mapping function

(iv)Queues

(v) Ring

Give illustrative examples in each case

6. Linked allocation of storage links nodes together by dividing each node into two fields or more.

(a) Using this approach, organize the following data in alphabetic order without moving them in store

Memory Address	Data Item
0011	Sodiya
0012	Ojo
0013	Vincent
0014	
0015	
0016	
0017	Onasoga
0018	Abayomi-Ali
0019	
0020	
0021	Tinubu
0022	Salako
0023	Aborishade
0024	
0025	Folorunso
0026	
0027	

(b) If you were to insert new items, Akinwale and Ojesanmi into the list, how would this be done?

(c) What are the two main advantages in the above scheme?

- binary - tracking ✓
ls & recursion of PMD
ced precedence ✓
n undo operation by an editor ✓

$P(A \cap B) = P(B)$

$P(A \cap B) = P(A) = P(B)$

$= P(A)$

$= P(B)$

$P(A|B) = \frac{P(A \cap B)}{P(B)}$

$= \frac{P(A)}{P(B)}$

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DEPARTMENT OF COMPUTER SCIENCE
2016/2017 FIRST SEMESTER DEGREE EXAMINATION
CSC 209 – COMPUTER LOGIC AND DIGITAL DESIGN (3 UNITS)

TIME ALLOWED: 2hrs 30Mins **Wednesday 19th July, 2017.**

INSTRUCTIONS: Answer all questions in section A, and any two questions in section B.

SECTION A

Question 1:

(a) Tabulate the values of the variables P, Q, R, S, T, and U in the circuit shown in Figure Q1(a) for all possible input variables A, B, C, and D. Complete the truth table as shown on Table Q1(a).

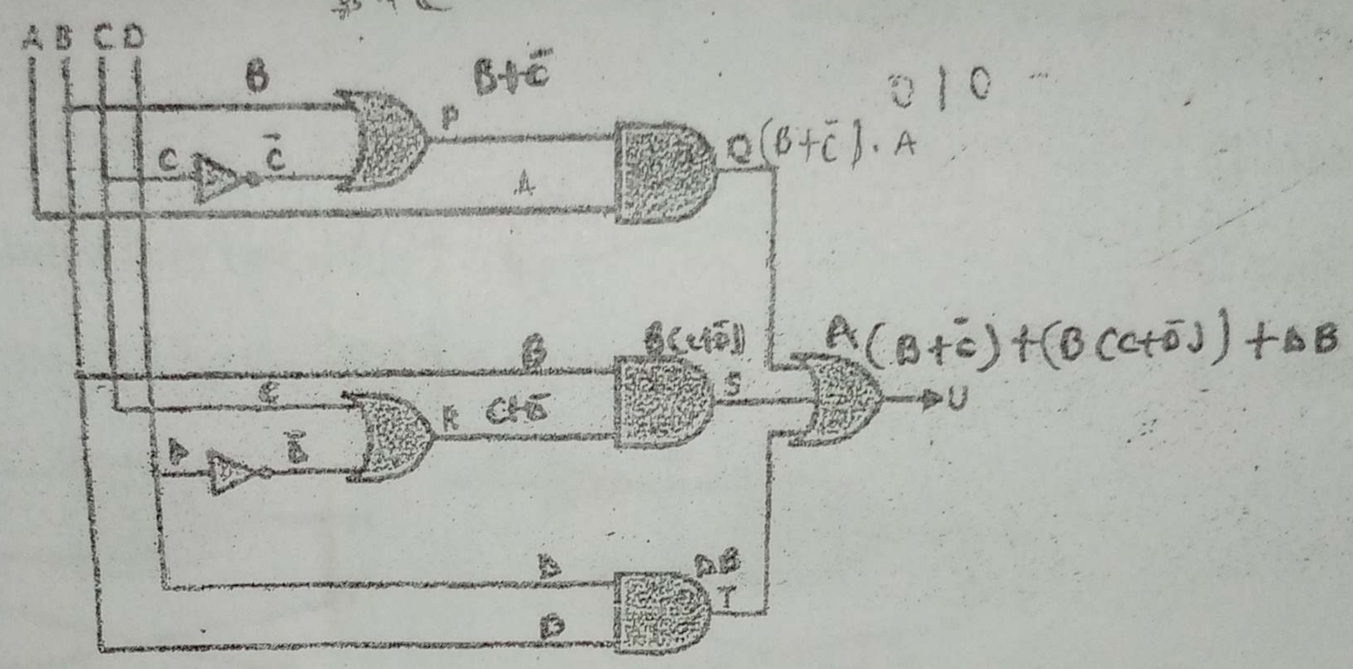

Figure Q1(a).

Table Q1(a). (6½ marks)

Inputs				Output					
A	B	C	D	$P = B + \bar{C}$	$Q = P.A$	$R = C + \bar{D}$	$S = B.R$	$T = B.D$	$U = Q + S + T$
0	0	0	0	1	0	1	0	0	0
0	0	0	1	1	.	.	.	.	.
0	0	1	0	0	.	.	.	.	.
0	0	1	1	0	.	.	.	.	.
0	1	0	0	1	.	.	.	.	.
0	1	0	1	1	.	.	.	.	.
.	.	.	.						
.	.	.	.						
.	.	.	.						
1	1	1	1	1	1	1	1	1	1

(b) For the circuit in Figure Q1(a), obtain the Boolean expression for the output U, in terms of the inputs A, B, C, and D by considering the logic function of each gate. (5 marks)

(c) Obtain a simplified Boolean expression for output U. (5 marks)

(d) Implement the minimum circuit for output U. (4 marks)

Question 2:

(a) Define the following terms: (4½ marks)

(i) Sum-of-products

(ii) Product of sums

(iii) Don't care condition

(b) Design a full Adder to perform the addition of three 4-bit numbers (X, Y, Z) with carry-in and carry-out, where X=1, Y=1, Z=1 and C_{in}=1 cannot occur. (15 marks)

SECTION B

Question 3:

(a) Explain the meaning and significance of the terms asynchronous and synchronous in sequential logic systems. (3 marks)

(b) (i) What is a shift register? (2 marks)

(ii) What is clock skew and how it is resolved? (3 marks)

(c) Demonstrate that the flip-flops in Figure 3(c) are equivalent. (7 marks)

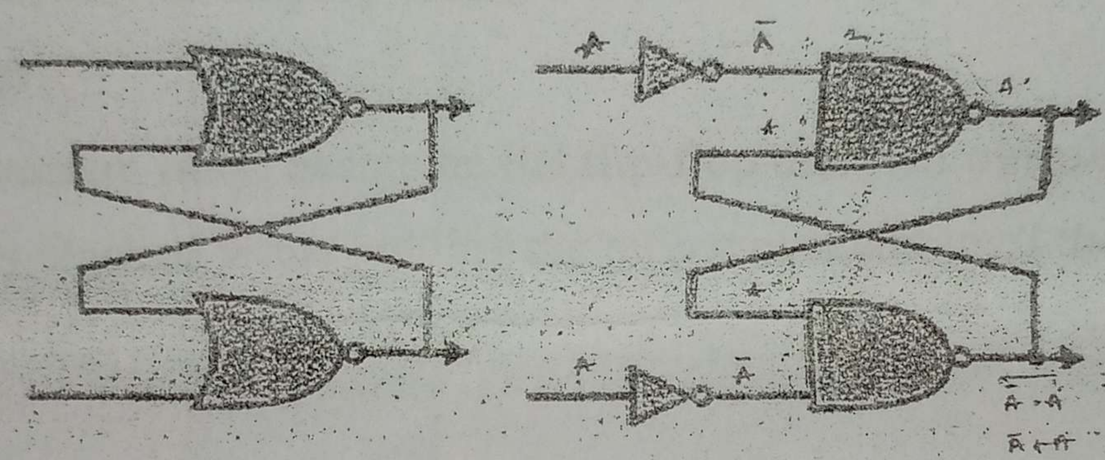

Figure 3(c).

Question 4

(a) Define the following terms: (4½ marks)

(i) Fan-in

(ii) Fan-out

(iii) Propagation delay

(b) The order to use a nuclear bomb is given by a Quartet made up of the President of the Republic (P), the Minister of defense (M), the Chief of the army (C) and the Director of the nuclear centre (D). Only the President of the Republic can unilaterally give the order to launch the bomb. Otherwise this responsibility can come from the minister of defence and at least one of two other members of the Quartet namely the Chief of the army or the Director of the nuclear centre.

(i) Draw the truth table of the system to launch the nuclear bomb (B); (4½ marks)

(ii) Simplify the output expression for B; (2 marks)

(iii) Implement B using appropriate gates; (2 marks)

(iv) Implement B using NAND gates only. (2 marks)

Question 5 (12½marks)

(a) Draw the Q and $\bar{Q}$ outputs of an RS flip-flop constructed from two NOR gates for the waveforms in Figure 5(a).

(4 marks)

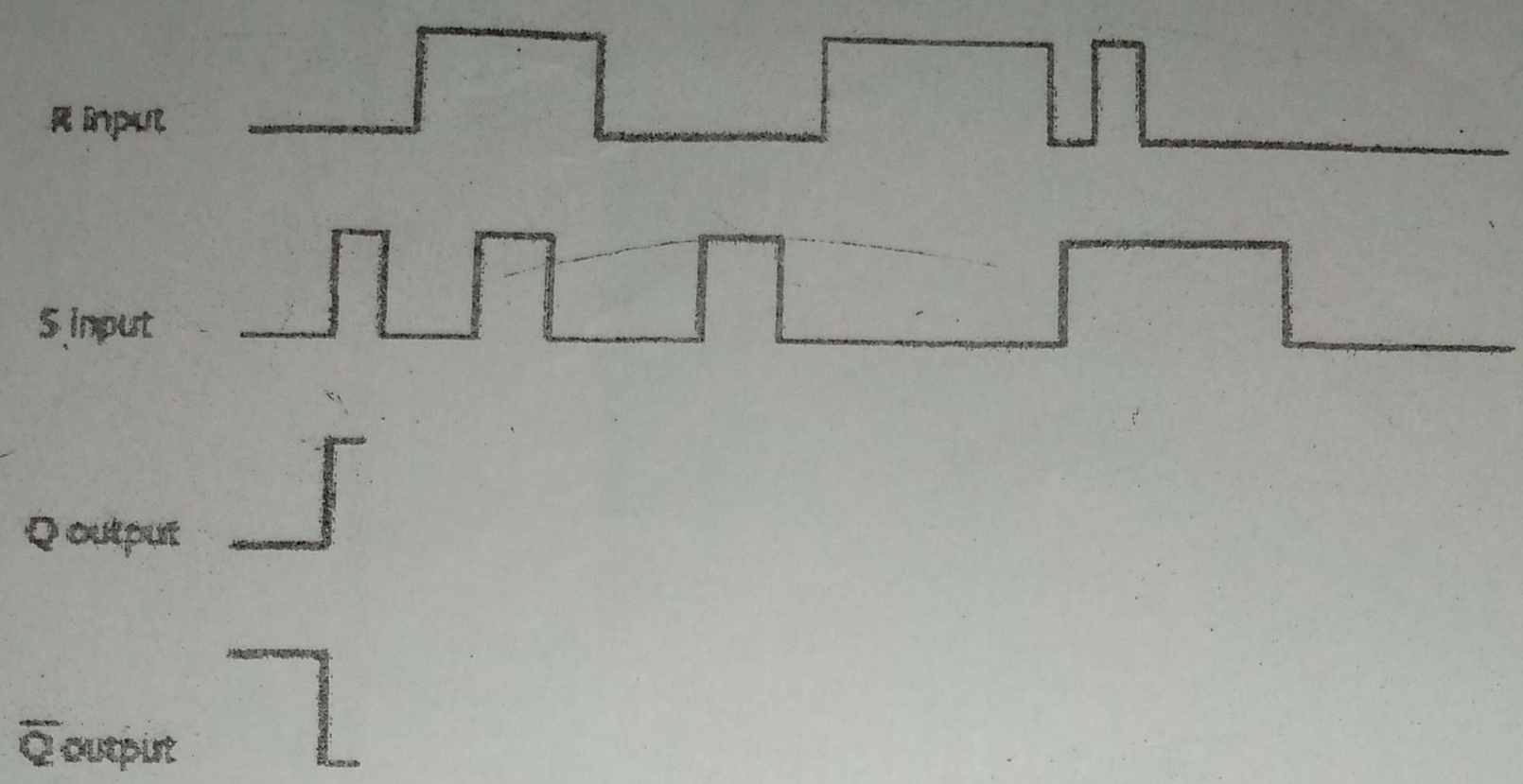

Figure 5(a).

(b) Explain why it is necessary to employ clocked flip-flops in sequential circuits (as opposed to unclocked flip-flops)?

(4 marks)

(c) Using appropriate diagram only, design an RS flip-flop that will transfer its input to the Q output each time it is clocked while holding the output constant until the next clock pulse.

(7 marks)

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2017/2018 FIRST SEMESTER DEGREE EXAMINATION
CSC 209 – COMPUTER LOGIC AND DIGITAL DESIGN (3 UNITS)

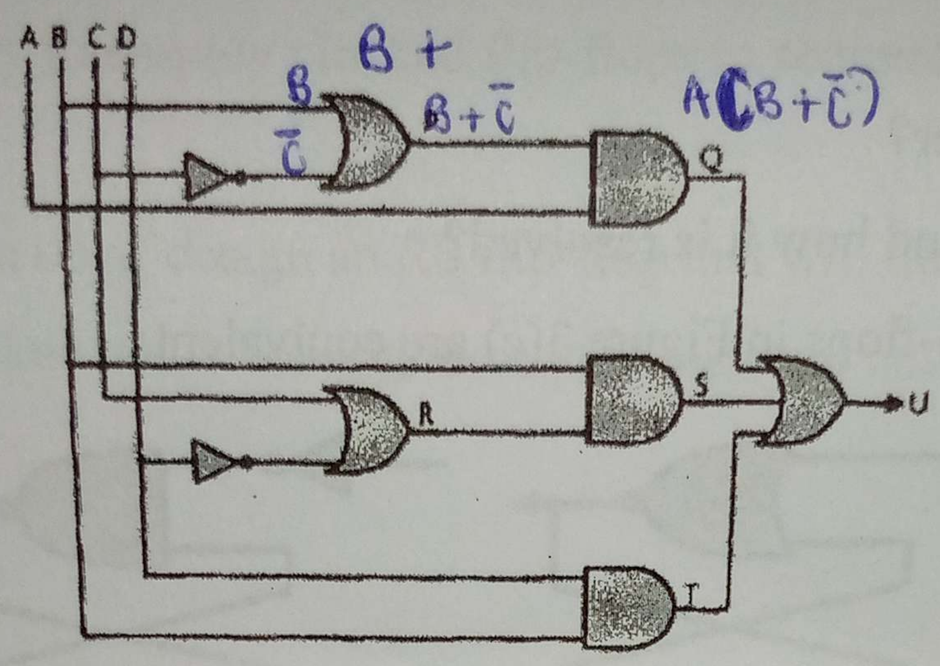
TIME ALLOWED: 2hrs 30Mins **Wednesday ~~19th July, 2017~~.** 1st August 2017

INSTRUCTIONS: Answer all questions in section A, and any two questions in section B.

SECTION A

Question 1:

(a) Tabulate the values of the variables P, Q, R, S, T, and U in the circuit shown in Figure Q1(a) for all possible input variables A, B, C, and D. Complete the truth table as shown on Table Q1(a).



$AB + AB + AC$
$= A + B \cdot A + B$
$A + B \cdot A + B \cdot A + C$
$A + B \cdot A + C$

Figure Q1(a).

Table Q1(a). (6½ marks)

Inputs				Output					
A	B	C	D	$P = B + \bar{C}$	$Q = P.A$	$R = C + \bar{D}$	$S = B.R$	$T = B.D$	$U = Q + S + T$
0	0	0	0	1	0	1	0	0	0
0	0	0	1	.	.	.	.	.	.
0	0	1	0	.	.	.	.	.	.
0	0	1	1	.	.	.	.	.	.
0	1	0	0	.	.	.	.	.	.
0	1	0	1	.	.	.	.	.	.
.	.	.	.						
.	.	.	.						
1	1	1	1	1	1	1	1	1	1

(b) For the circuit in Figure Q1(a) obtain the Boolean expression for the output U, in terms of the inputs A, B, C, and D by considering the logic function of each gate. (5 marks)

(c) Using algebraic method only, obtain a simplified expression for output U. (5 marks)

(d) Implement the minimum circuit for output U using NAND gates only. (4 marks)

$A(B+\bar{C}) + B(C+\bar{D}) + BD$

Question 2:

(a) Define the following terms:

(i) Sum-of-products

(ii) Product of sums

(iii) Don't care condition

(4½ marks)

(b) Design a full Adder to perform the addition of three 4-bit numbers (X, Y, Z) with carry-in and carry-out, where X=1, Y=1, Z=1 and C_{in}=1 cannot occur. (15 marks)

SECTION B

Question 3:

(a) Explain the meaning and significance of the terms asynchronous and synchronous in sequential logic systems. (3 marks)

(b) (i) What is a shift register? (2 marks)

(ii) What is clock skew and how it is resolved? (3 marks)

(c) Demonstrate that the flip-flops in Figure 3(c) are equivalent. (7 marks)

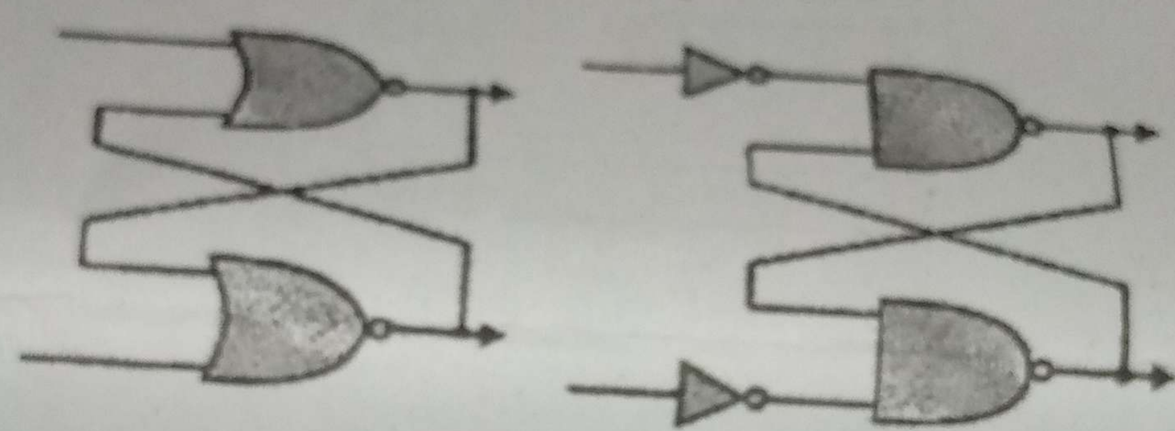


Figure 3(c).

Question 4

(a) Define the following terms:

(i) Fan-in

(ii) Fan-out

(iii) Propagation delay

(4½ marks)

(b) A logic circuit has three inputs C, B, and A, where A is the least-significant bit. The circuit has three outputs R, Q, and P. For any binary code applied to the input terminals (A, B, and C) the output is given by the input plus 1; for example, if C, B, A = 0,1, 1, the output R, Q, P is 1,0,0. Note that 111 + 1 = 000 (i.e. there is no carry out). Design a circuit to implement this system.

Question 5 (12½marks)

(a) Draw the Q and $\bar{Q}$ outputs of an RS flip-flop constructed from two NOR gates for the waveforms in Figure 5(a).

(4 marks)

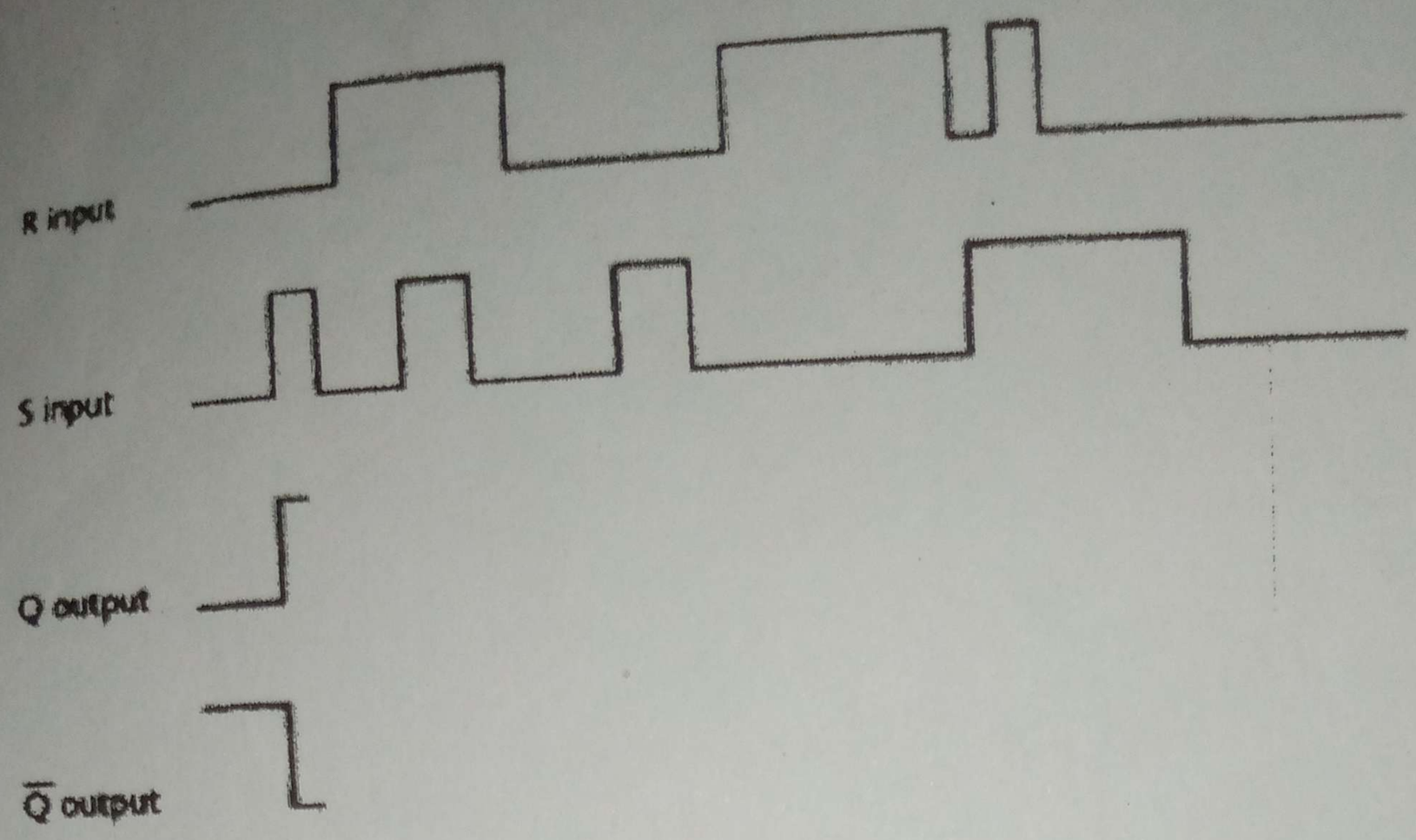


Figure 5(a).

(b) Explain why it is necessary to employ clocked flip-flops in sequential circuits (as opposed to unclocked flip-flops)? *(4 marks)*

(c) Using appropriate diagram only, design an RS flip-flop that will transfer its input to the Q output each time it is clocked while holding the output constant until the next clock pulse. *(7 marks)*

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DEPARTMENT OF COMPUTER SCIENCE
2018/2019 FIRST SEMESTER DEGREE EXAMINATION
CSC 209 – COMPUTER LOGIC AND DIGITAL DESIGN (3 UNITS)

TIME ALLOWED: 2hrs 30Mins **Wednesday 11th September, 2019.**
INSTRUCTIONS: Answer all questions in section A, and any two questions in section B.

SECTION A

Question 1: (22 marks)

(a) A circuit that controls a given digital system has three inputs: x_1, x_2, and x_3. it has to recognize three different conditions:

- Condition A is true if x_3 is true and either x_1 is true or x_2 is false
- Condition B is true if x_1 is true and either x_2 or x_3 is false
- Condition C is true if x_2 is true and either x_1 is true or x_3 is false

The control circuit must produce an output of 1 if at least two of the conditions A, B, and C are true. Design the simplest circuit that can be used for this purpose.

Question 2:

(a) Define the following terms: (4½ marks)

(i) Sum-of-products

(ii) Product of sums

(iii) Don't care condition

(b) Design a full Adder to perform the addition of three 4-bit numbers (X, Y, Z) with carry-in and carry-out, where X=1, Y=1, Z=1 and C_{in}=1 cannot occur. (11½ marks)

SECTION B

Question 3:

(a) Explain the meaning and significance of the terms asynchronous and synchronous in sequential logic systems. (3 marks)

(b) With the aid of an appropriate diagram describe the application of the flipflop in the shift register? (5 marks)

(c) Using the truth table only, determine if the expression is valid logically.

$$\overline{x_1}\,\overline{x_3} + X_2X_3 + X_1\overline{x_2} = \overline{x_1}\,X_2 + X_1X_3 + \overline{x_2}\,\overline{x_3}$$ (8 marks)

Question 4

(a) Define the following terms: (3 marks)

(i) Hold time

(ii) Setup time

11/2

$Pm(c\bar{D}+1)' + Pm + Pm$

(b) The order to use a nuclear bomb is given by a Quartet made up of the President of the Republic (P), the Minister of defense (M), the Chief of the army (C) and the Director of the nuclear centre (D). Only the President of the Republic has the ability to unilaterally give the order to launch the bomb. Otherwise this responsibility can come from the minister of defense and at least one of two other members of the Quartet namely the Chief of the army or the Director of the nuclear centre.

(a) Draw the truth table of the system to launch the nuclear bomb; (6 marks)

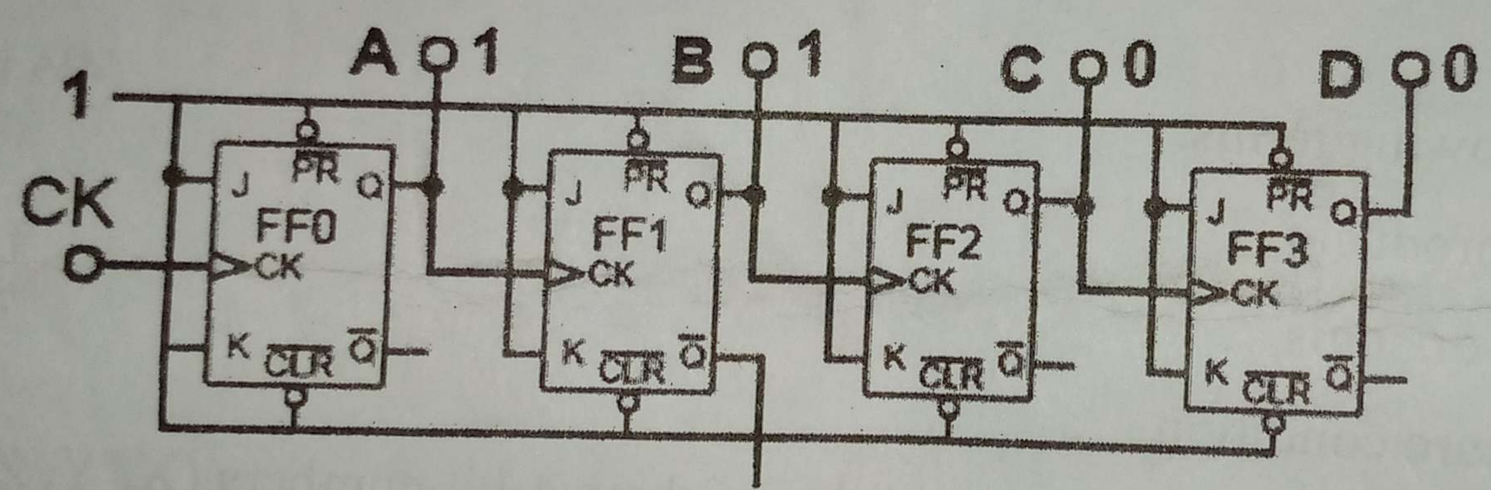
(b) Simplify the output equation B; (2 marks)

(c) Implement the logic diagram of B using appropriate gates; (2 marks)

(d) Implement the logic diagram using NAND gates only. (3 marks)

Question 5

(a) After 2 more clock pulses what will be the logic states on outputs A, B, C and D. (4 marks)



(b) Explain why it is necessary to employ clocked flip-flops in sequential circuits (as opposed to unclocked flip-flops)? (4 marks)

(c) Using appropriate diagram only, design an RS flip-flop that will transfer its input to the Q output each time it is clocked while holding the output constant until the next clock pulse. (8 marks)

$\bar{c}D \rightarrow \bar{P}m(c+\bar{c})(D+\bar{D})$

$c\bar{D}$

$\bar{m}\bar{c}\bar{D} \rightarrow Pm\bar{c}(D+D)$

$\bar{m}\bar{c}D$

$\bar{m}c\bar{D} \rightarrow Pc(m+\bar{m})(D+\bar{D})$

mcD

$m\bar{c}\bar{D} \rightarrow Pm\bar{c}(D+D)$

$m\bar{c}D \rightarrow Pmc(D+D)$

CD \ Pm	00	01	11	10
00				1
01		1	X	1
11		1	X	1
10			X	1

$Pm\bar{c}\bar{D}$

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER EXAMINATION 2017/2018 SESSION

COURSE CODE: CSC 205
COURSE TITLE: DISCRETE COMPUTATION
INSTRUCTION: Answer Question **ONE** and any other **THREE** questions
TIME ALLOWED: 2 ½ HOURS

QUESTION 1:

a) i) Define a Partition of a set?
ii) List the conditions to be satisfied for Partitioning
iii) What is the relevance of this Partitioning in Computing?

b) i) Enumerate five (5) applications of Graph models, stating in each model the vertices, edges and resulting type(s) of graph.
ii) Describe a graph that models e-mail messages sent in a network in a particular week.

c) How many relations exist on a set with n elements? (Show ALL workings)

d) Construct a digital circuit that will produce the output $xyz + x\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}\,\bar{y}z$

QUESTION 2:

a) What is the relevance of identities in Boolean Algebra?
b) List eight (8) Boolean identities and their corresponding names
c) Show that $F(x,y,z) = (x + y)\bar{z} = xy\bar{z} + x\bar{y}\,\bar{z} + \bar{x}y\bar{z}$ using identities of Boolean Algebra

QUESTION 3:

a) List two (2) applications of Matrices

b) If $\mathbf{A} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$, Find $\mathbf{A}^{|5|}$

c) Suppose that the relations $\mathbf{R_1}$ and $\mathbf{R_2}$ on a set $\mathbf{Z}$ are represented by the matrices

$$\mathbf{M_{R1}} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix} \quad \text{and} \quad \mathbf{M_{R2}} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

What are the matrices representing $\mathbf{R_1} \cap \mathbf{R_2}$ and $\mathbf{R_1} \cup \mathbf{R_2}$?

QUESTION 4:

a) Draw the diagram of each of the following graphs G = (V, E):
(i) V = {1, 2, 3, 4, 5} and E = {{1, 2}, {1, 4}, {1, 5}, {2, 3}, {3, 4}, {4, 5}}
(ii) V = {1, 2, 3, 4, 5, 6} and E = {{1, 2}, {1, 4}, {1, 4}, {2, 3}, {2, 5}, {3, 5)}
b) Draw the diagrams of the Complements of the graphs in (a) above

c) i) What is Graph isomorphism?

ii) Show that if two graphs **G** and **G'** are isomorphic, the order of **G** is equal to the order of **G'** and the size of **G** is equal to the size of **G'**

QUESTION 5:

a) List two (2) applications of Counting

b) i) How many bit strings of length ten either starts with a **0** bit or ends with the two bits **11**?

ii) How many bit strings of length eight contain either three consecutive 0s or four consecutive 1s?

c) Let E be the event that a randomly generated bit string of length three contains an odd number of 1s, and let F be the event that the string starts with 1. Are E and F independen t for a 8 bit strings of length three?

QUESTION 6:

a) List 3 applications of Logic in a world of computing

b) List 3 bit operators and show their corresponding operations $\forall$ x, y

c) Consider these relations on the set of integers,

$R_1 = \{(a,b) \mid a \leq b\}$,

$R_2 = \{(a,b) \mid a > b\}$,

$R_3 = \{(a,b) \mid a = b \text{ or } a = -b\}$,

$R_4 = \{(a,b) \mid a = b\}$,

$R_5 = \{(a,b) \mid a = b+1\}$,

$R_6 = \{(a,b) \mid a+b \leq 3\}$

With sufficient reasons, which of these relations are:

i) Reflexive ii) Symmetric iii) Transitive iv) Antisymmetric

bi) $2^9 + 2^8$

$= 2^{17}$

bii) $2^5 + 2^4$

$= 2^9$

Cutly - To assign numerical value to a group of objects

- .

uses - It is used to establish logical relationships

eons provides the basis for analysing & validity of logical

pp: it is the fundamental of computer circuits

Computer programing

Mathematical logics

$|S| = 8$

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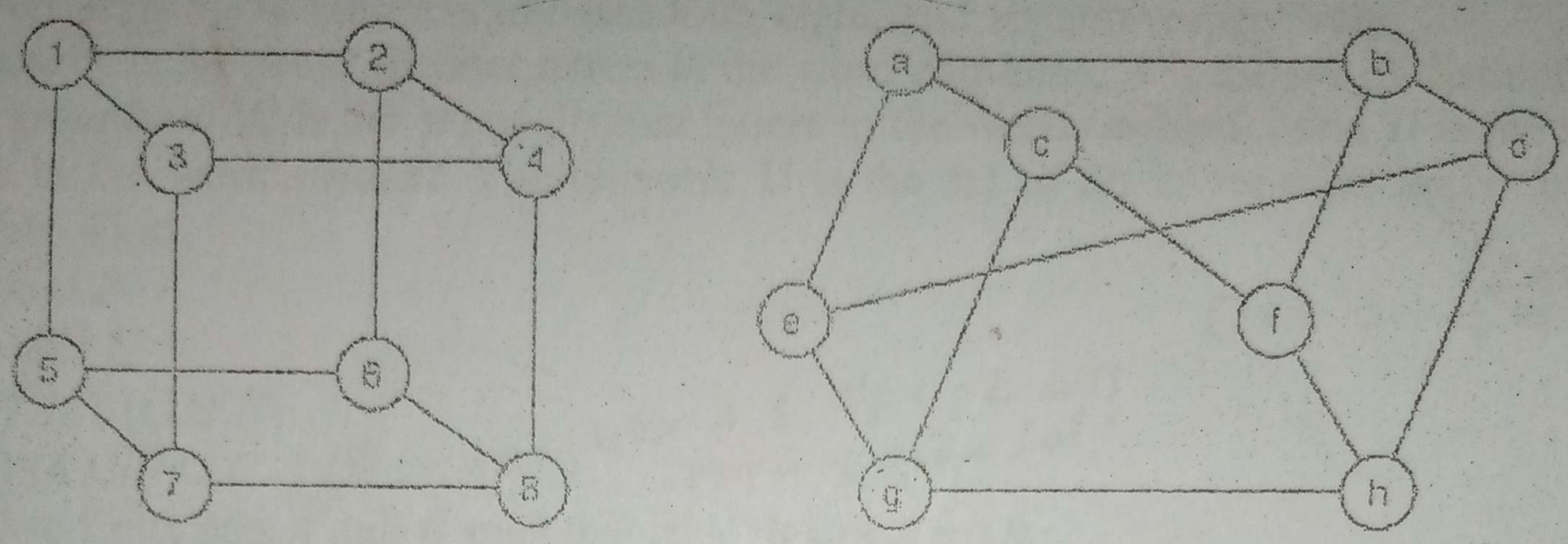
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER 2016/2017 UNIVERSITY EXAMINATIONS
CSC205 – DISCRETE COMPUTATION

Instructions: *Answer four* questions in all. Time Allowed: *2½ hours*

1(a) Define what it means for a graph to be bi-partite.
(b) Prove that every cycle in a bi-partite graph has even length.
(c) Find an isomorphism, if any, between the following pair of graphs. If they are not isomorphic, explain why they are not.



2(a) Draw the diagram of each of the following graphs G = (V, E):
(i) V = {1, 2, 3, 4, 5} and E = {{1, 2}, {1, 4}, {1, 5}, {2, 3}, {3, 4}, {4, 5}}
(ii) V = {1, 2, 3, 4, 5, 6} and E = {{1, 2}, {1, 4}, {1, 4}, {2, 3}, {2, 5}, {3, 5)}
(b) Draw the diagrams of the complements of the graphs in (a) above
(c) Show that the complement of a bipartite graph need not be a bipartite graph

3(a) Write short note on each of the following terms:
(i) Graph
(ii) Simple graph
(iii) Multigraph
(iv) Bipartite graph
(v) Tournament
Give an example in each case

4 Consider the two isomorphic graphs G and H given below in figure Q_4.

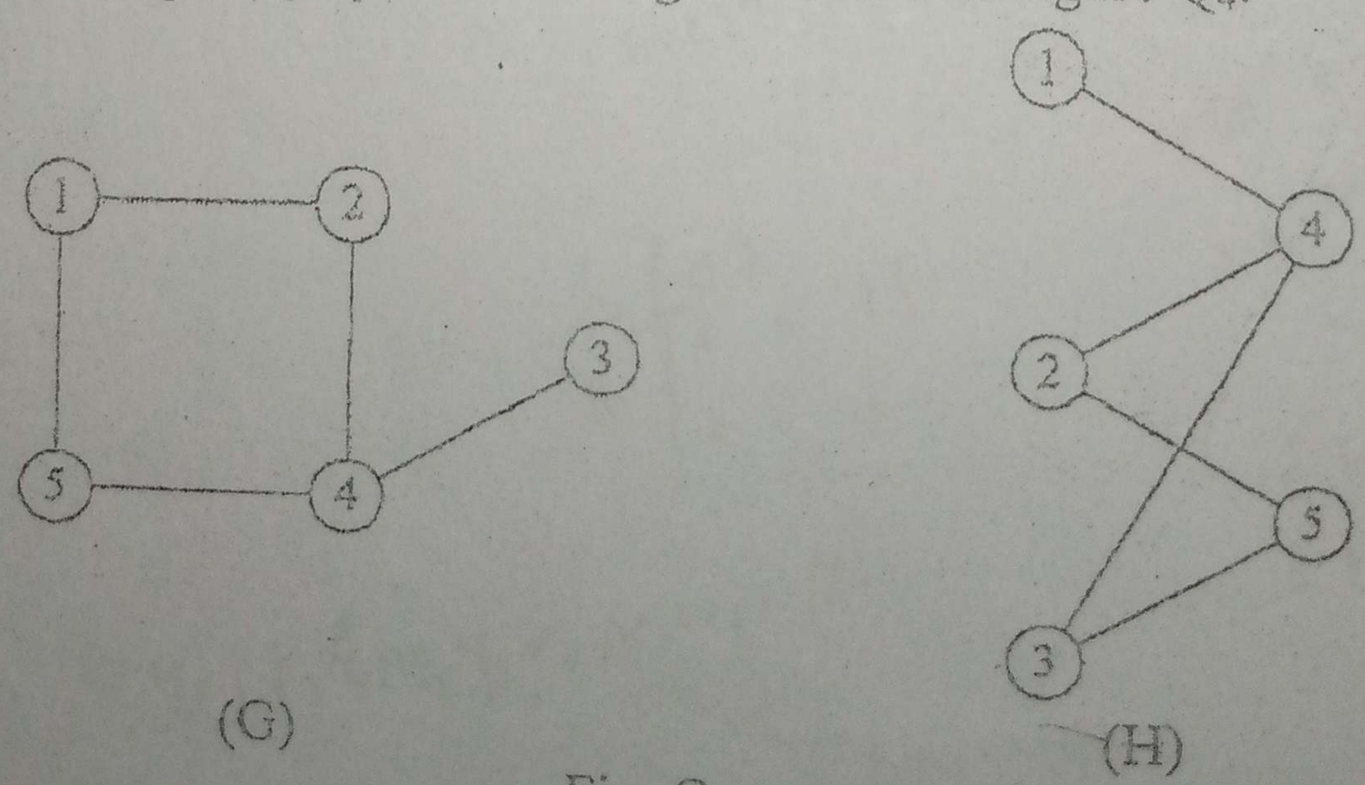


Fig. Q_4

(a) Find the adjacency matrices A_G and A_H of the two isomorphic graphs.
(b) Obtain a permutation matrix P such that $A_H P = P A_G$

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5(a) If A, B and C are sets, show that $A - (B \cup C) = (A - B) \cap (A - C)$.

(b) Copy and complete the boolean tables given below

$a \oplus b$

a	b	a OR b
0	0	0
0	1	1
1	0	1
1	1	1

A	b	a AND b
0	0	0
0	1	0
1	0	0
1	1	1

a	b	a XOR b
0	0	0
0	1	1
1	0	1
1	1	0

(c) Given that f is a function $\exists\ f : A \to B$ where $A = \{a, b, c, d\}$ and $B = \{1, 2, 3\}$ with $f(a) = 3$, $f(b) = 2$, $f(c) = 1$, and $f(d) = 3$. Is f onto? Why?

6(a) Convert 27.125_{10} to numbers in bases four, eight, and sixteen respectively.

(b) Suppose A is the set of distinct letters in the word *elephant*, B is the set of distinct letters in the word *sycophant*, C is the set of distinct letters in the word *fantastic*, and D is the set of distinct letters in the word *student*. The universe U is the set of 26 lower-case letters of the English alphabet. Find

(i) $A \cup B$

(ii) $A \cap C$

(iii) $A \cap (C \cup D)$

(iv) $(A \cup B \cup C \cup D)'$ – "any letter in the alp. a-z but not in the given set"

(c) Find two finite sets A and B such that $A \in B$ and $A \subset B$.

$C \cup D = f\ a\ n\ t\ s\ i\ c$

A

$U = \{a, b, c, d \ldots z\}$

$A =$ elephant

$B =$ Sycophant

$C =$ fantastic

$D =$ Student

$(A \cup B) = \{e, l, p, h, s, y, c\}$

$A \cap C = \{s, c, a, n, t\}\ \{e, t, n\}$

$A \cap (C \cup D) = \{e, a, n, t\}$

$2 \times \frac{1}{4^{2}}$

0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0

$1 \times 4^{-1} + 2 \times 4^{-2} + 5 \times 4^{-3}$

$0.25 + 0.125 + 0.078125$

0.453125

0.125

$1 \times 16^{-1} + 2 \times 16^{-2} + 5 \times 16^{-3}$

$0.125 + 0.0078125 + 0.001220703$

0.015332 – 16 decimal

2017247

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER EXAMINATION 2018/2019 SESSION

COURSE CODE: CSC 205
COURSE TITLE: DISCRETE COMPUTATION
INSTRUCTION: Answer Question **ONE** and any other **THREE** questions
TIME ALLOWED: 2 ½ HOURS

QUESTION 1:

a) Enumerate five (5) applications of Graph models, stating in each model the vertices, edges and resulting type(s) of graph.

b) i) What is the importance of identities in Boolean Algebra?
ii) List eight (8) Boolean identities and their corresponding names

c) i) Define a Partition of a set? List the conditions to be satisfied for Partitioning
ii) What is the relevance of this Partitioning in Computing?

d) i) What is the relevance of Relations in Computing?
ii) How many relations exist on a set with n elements? (Show ALL workings)

e) From a 16 bit string of length four, a four bit string is randomly generated. What is the probability that it contains at least two consecutive 0s, given that its first bit is a 0?

QUESTION 2:

a) List two (2) applications of Matrices

b) If $\mathbf{A} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$, Find $\mathbf{A}^{|5|}$

c) Suppose that the relations $\mathbf{R_1}$ and $\mathbf{R_2}$ on a set $\mathbf{Z}$ are represented by the matrices

$$\mathbf{M_{R1}} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix} \quad \text{and} \quad \mathbf{M_{R2}} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

What are the matrices representing $\mathbf{R_1} \cap \mathbf{R_2}$ and $\mathbf{R_1} \cup \mathbf{R_2}$?

QUESTION 3:

(1,8) (1,6) (2,3) (4,1)

a) Draw the diagram of each of the following graphs G = (V, E):
i) V = {1, 2, 3, 4, 5, 6} and E = {{1, 2}, {1, 3}, {1, 4}, {2, 5}, {2, 6}, {3, 5}, {3, 6}, {4, 5}, {4, 6}}
ii) V = {1, 2, 3, 4, 5} and E = {{1, 2}, {1, 4}, {2, 3}, {2, 4}, {2, 5}, {3, 4}, {3, 5}}

b) Draw the diagrams of the complements of the graphs in (a) above.

1,2 2,1 2,5 3,1 3,2 4,5 5,1

c) Let E be the event that a randomly generated bit string of length three contains an odd number of 1s, and let F be the event that the string starts with 1. Are E and F independent for a 8 bit strings of length three?

QUESTION 4:

a) Write short notes on the following and give an example in each case:

(i) Digraph
(ii) Complete graph
(iii) Pseudograph
(iv) Bipartite graph
(v) Degree of a vertex

b) Draw a complete graph with 7 vertices.

c) Describe a graph that models e-mail messages sent in a network in a particular week.

QUESTION 5:

a) List two (2) applications of Counting

b) i) How many bit strings of length seven either begin with two 0s or end with three 1s?

ii) How many bit strings of length eight contain either three consecutive 0s or four consecutive 1s?

c) Construct a digital circuit that will produce the output $xyz + x\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}\,\bar{y}z$

QUESTION 6:

a) List four (4) applications of Logic in a world of computing

b) Find the Boolean product of **A** and **B**, **A⊙B** where

$$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 1 & 0 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

c) Find the bitwise OR, bitwise AND and bitwise XOR of the bit strings 01 0011 0110 and 11 0001 1101

FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF MATHEMATICS

Date:
Friday, 20th Sept., 2019

BSc. Degree Examinations, First Semester 2018/2019
Course Title: LINEAR ALGEBRA I (MTS 213)

Instruction: Answer ANY THREE Questions ONLY. Time: 2 Hours

1. (a) Define the following:

   (i) Vector Spaces

   (ii) Subspaces

   (iii) Linear combination of vectors

   (iv) Linear dependence

   (v) Linear independence

   (b) Let $H = \{(x, y, z) : x = at, y = bt, z = ct; a, b, c \in \Re\}$. Show that H is a subspace of $\Re^3$.
   (c) The members of the set A are of the form $m + n\sqrt{2}, m, n \in \mathbf{Q}$. Show that A forms a vector space over the field $\Re$ of real numbers.

2. (a) Let $T : V \longrightarrow H$ be a linear map. Show that T is injective if and only if $Ker\ T = 0$.
   (b) Using matrix factorisation, solve the system of equations

$$\begin{aligned} a - 2b + 7c &= 2 \\ 2a + 4b - 3c &= -1 \\ -3a + 7b + 2c &= 3 \end{aligned}$$

   (c) Show that the matrix $A = \begin{pmatrix} 1 & 2 & 4 & 3 \\ 2 & 1 & 3 & 2 \\ 1 & -1 & 2 & 3 \end{pmatrix}$ is row equivalent to the matrix

$$B = \begin{pmatrix} 2 & 4 & 8 & 6 \\ 1 & -1 & 2 & 3 \\ 4 & -1 & 7 & 8 \end{pmatrix}$$

3. (a) Let V be a finite dimensional vector space with basis B given as $\{v_1, v_2, ..., v_n\}$. Let $\{u_1, u_2, ..., u_n\}$ be n-vectors in H. Suppose that $T_1, T_2 : V \to H$, such that $T_1 V_i = T_2 V_i = U_i$ $\forall\, i = 1, 2, ..., n$. Then for any $v \in V$, show that $T_1 v = T_2 v$.
   (b) Let $T : \Re^2 \longrightarrow \Re^2$ be a linear operator defined by $T(x, y) = (2x - 3y, x + y)$. Consider the following bases of $\Re^2$: $\{e_1 = (1, 0), e_2 = (0, 1)\}; \{u_1 = (1, 2), u_2 = (2, 3)\}$
   (i) Find the transition matrices P and Q from $\{e_i\}$ to $\{u_i\}$ and from $\{u_i\}$ to $\{e_i\}$ respectively and verify that $Q = P^{-1}$.
   (ii) Show that $[V]_e = P[V]_u$ for any $v \in \Re^2$.
   (iii) $[T]_u = P^{-1}[T]_e P$.

$23 - (\frac{47}{8})$ $\quad \frac{23}{8} + \frac{8}{8}$

$\times 23 + \frac{47}{8}$ $\quad \frac{27}{8}$

Student's name:

4. (a) Determine the row-canonical form of

$$\begin{pmatrix} 0 & 1 & 3 & -2 \\ 2 & 1 & -4 & 3 \\ 2 & 3 & 2 & -1 \end{pmatrix}$$

(b) Let $T : \Re^3 \longrightarrow \mathbf{P_2}$ be defined by $T(a, b, c) = ax^2 + bx + c$. Show that $\Re^3 \cong \mathbf{P_2}$.
(c) If A is an n-square matrix. Show that the homogenous system $AX = 0$ has a non-trivial solution iff A is singular.

5. (a) Let $T : V \to H$ be a linear mapping. Then define the following:
(i) Linear Transformation.
(ii) Ker T
(iii) Range T
When is T said to be:
(iv) injective
(v) surjective
(vi) an isomorphism
(b) Let $T : C[0, 1] \to \Re$ be defined by

$$Tf = f(0) + 1$$

Show whether T is linear or not.

(c) Find the inverse of matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 3 \\ 5 & 5 & 1 \end{pmatrix}$ if it exists.

$\frac{1}{1} - \frac{2}{2}$

$\frac{2}{2} - \frac{3}{2}$

$\frac{3}{2} - \frac{1}{2}$

$\frac{2}{2}$

$\frac{8}{8} + \frac{5}{8}$

$\frac{13}{8}$

$+(2 \times -1$

$(2 - 15) - (0 - 25) + 1(0 - 10)$

$13 + 15 - 10$

$\frac{28}{-10}$
18

$|A|$

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA

COLLEGE OF PHYSICAL SCIENCES

DEPARTMENT OF STATISTICS

2017/2018 First Semester B.Sc. Degree Examination

Course Title: Probability II
Instruction: Answer ANY 4 questions
Date Conducted: Tuesday, 7th August, 2018

Course Code/Unit: STS 213/221/231/281 3C
Class: 200 Level: CSC, MTS & STS
Time Allowed: 2½ Hours

QUESTION ONE

a. Define Discrete and Continuous random variables and give expressions to determine their expectations

b. Differentiate between Discrete and Continuous Probability Distributions and give 3 examples of each

c. State four properties of expectation and variance for random variables

d. The continuous random variable X has probability density function *f(x)* define by

$$F(x) = \begin{cases} \frac{c}{x^4} & (x < -1) \\ c(2 - x^2) & (-1 \leq x \leq 1) \\ \frac{c}{x^4} & (x > 1) \end{cases}$$

i. Show that $C = \frac{1}{4}$

ii. Determine the expected value of x

iii. Determine the variance of x

QUESTION TWO

A continuous random variable X is defined by the Probability Density Function (P.D.F.)

$$f(x) = \frac{1}{b - a} \quad , \quad a \leq x \leq b$$

a. (i) Name the distribution (ii) Determine the mean, E(x) (iii) Determine the variance, V(x)

b. If the constants a and b are1.5 and 5.5 respectively, find P(X ≤ 3).

QUESTION THREE

a. If there is a probability of 0.2 of failure to get through in any attempt to make a telephone call, calculate the most probable number of failures in ten attempts, and also the probability of three or more failures in ten attempts

b. Given the table below

X	0	2	6	10
P(X)	2/8	3/8	1/8	2/8

(i) What is the name given to the table

(ii) Find using method of Expectation (a) the mean (b) second moment (c) third moment

QUESTION FOUR

a. A bag contains two red and eight black marbles. A sample of four marbles is to be drawn at random from the bag without replacement.

(i) Show that the probability of obtaining exactly two red marbles in the sample is 2/15

(ii) Show that the probability of obtaining exactly one red marble in the sample is 8/15

(iii) Calculate the expected number of red marbles that will be drawn

b. The diameter of washers produced by a machine has a standard deviation of 0.1 mm. What should the mean diameter be if there is to be a probability of only 3% that the diameter exceeds 2.0 mm.

QUESTION FIVE

a. A continuous variable X is distributed at random between two values, $x = 0$ and $x = 2$, and has a probability density function of $ax^2 + bx$. The mean is 1.25

(i) Show that $b = ¾$, (ii) Find the value of a (iii) Find the variance of X

b. Given that $f(x) = P(1 - P)^{x-1}$, x = 1, 2, 3, ...

(i) Identify the PDF (ii) Give short explanation on its type of experiment with respect to it parameter

c. The probability of a successful optical alignment in the assembly of an optical data storage product is 0.8. Assume the trials are independent.

(i) What is the probability that the first successful alignment requires exactly four trials?

(ii) What is the probability that the first successful alignment requires at most four trials?

(iii) What is the probability that the first successful alignment requires at least four trials?

QUESTION SIX

a. State four concepts of probability

b. Define

i. A Trial

ii. An event

iii. An outcome

iv. Sample space

c. A certain item is produced by 3 factories, say Factory 1, Factory 2 and Factory 3. It is known that Factory 1 turns out twice as many items as Factory 2 and that Factory 2 and Factory 3 turn out the same number of items (during a specified production period). It is also known that 2% of items produced by Factory 1 and Factory 2 are defective while 4% of those manufactured by Factory 3 are defective. All items produced are put into one stockpile and then one item is chosen at random.

i. Determine the probability that the chosen item is defective

ii Determine the probability that the chosen item is manufactured by Factory 1

iii Which factory it is likely to have produced the chosen defective item? Give reason

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
2018/2019 FIRST SEMESTER EXAMINATION

COURSE TITLE: NUMERICAL COMPUTATION
COURSE CODE: CSC 271/ CSC 251/ CSC351
TIME: 2 hours, 30 mins.
INSTRUCTION: Answer any four questions and show the details of all your calculations.

QUESTION ONE

(a) Develop a simple algorithm for Bisection method for a solution $f(x) = 0$, given the continuous function f on the interval $[a, b]$, where $f(a)$ and $f(b)$ have opposite signs.

(b) Use bisection method to obtain a root for

$$f(x) = x^6 - x - 1,$$

with $a = 1$ and $b = 2$ as the starting point, correct to four *(4)* decimal places. Compute five iterations and tabulate your results.

c) Find $P'(-2)$ of the polynomial equation below using Horner's method.

$$P'(x) = 2x^4 - 3x^2 + 3x - 4.$$

QUESTION TWO

(a) Write a C-program for Newton-Raphson Method.

(b) Determine the real root of the equation $5sin^2x - 8cos^5x$ using Newton-Raphson method for three *(3)* iterations and correct to five *(5)* decimal places.. N.B: x is measured in radian and $x_0 = 0.5$.

(c) Find an approximation to the smallest positive root of the equation

$$x^2 - 4x = -2$$

using fixed point formula with $x_0 = 0.4$.

QUESTION THREE

(a) Use the table below to find $\Delta^3 y_0$ by forward difference table.

x	0.61	0.62	0.63	0.64	0.65	0.66	0.67
$y = e^x$	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

(b) Given $(n + 1)$ values, via $(x_0, y_0), (x_1, y_1), (x_2, y_2) \ldots\ldots\ldots (x_n, y_n)$ of x and y. It is required to find $y_n(x)$, a polynomial of nth degree such that y and $y_n(x)$ agree at tabulated points. Show that

$$y_n(x) = y + p\Delta y_0 .$$

(c) Write a C sub-program for Striling Interpolation Formula.

QUESTION FOUR

½ (a) Let $f(x) = xe^x$, use three and five points central difference formulas to find $f'(2)$ if $h = 0.005$. Correct to five *(5)* decimal places and compare with exact solution.

(b) State Maclaurin's series and obtain the first three *(3)* non-zero terms in the expansion of $\ln(1 + x)$ using Maclaurin's series.

(c) Evaluate $\left(1 + \frac{1}{50}\right)^8$ using Binomial series correct to five *(5)* significant figures.

QUESTION FIVE

(a) A function $y = f(x)$ is defined as follows :

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

Compute the values of dy/dx and d^2y/dx^2 at $x = 1.4$.

(b) Evaluate

$$I = \int_0^2 e^x \, dx$$

using Trapezoidal and Simpson rules with h = 0.5.

(c) Write a C program to implement Trapezoidal rule.

QUESTION SIX

(a) Develop a simple algorithm for fourth order Runge kutta formula

(b) Given $y' = y - x^2 + 1$, where $y = 0.5$ and $x = 0$. Find $y(0.2)$ and $y(0.4)$ using Runge-Kutta fourth order formula. Correct to six*(6)* decimal places.

(c) Given $\frac{dy}{dt} = te^{3t} - 2y$ at $0 \le t \le 1$ where $y(0) = 0$. Compute $y(0.5)$ and $y(1)$ using Euler's method correct to five *(5)* decimal places.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1

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FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
2018/2019 FIRST SEMESTER UNIVERSITY EXAMINATION

COURSE TITLE: Information Technology Law and Ethics (1C)
COURSE CODE: CSC 215/225
INSTRUCTION: Answer **Question One** and any other **two** questions.
TIME ALLOWED: 1hr.

1a(i) What is Information Technology law? (5 mks)
(ii) Discuss the IT related crimes that are prevalent in our modern society. (10 mks)
b. Discuss the legal and ethical issues in Information Technology. (15 mks)
c. Is the Internet 'lawless'? Support your claims with different acts guiding Information Technology. (10 mks)

2a. Discuss five (5) areas in which computer is useful in Law. (5 mks)
b. Identify common unethical and unprofessional business habits that serve as challenges to most companies. (10 mks)

3a. Discuss the relevance of computer in Medicine. (10 mks)
b. Mention five (5) disadvantages of computer in medicine (5 mks)

4a. Briefly discuss the importance of computers in the Business World. (10 mks)
b. Mention five (5) primary advantages of computers in education. (5 mks)

5a. What is electronic governance? (5 mks)
b. Mention ten (10) roles of computers in e-governance? (10 mks)

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
2017/2018 FIRST SEMESTER EXAMINATION

COURSE TITLE: NUMERICAL COMPUTATION
COURSE CODE: CSC 271/ CSC 251/ CSC351
TIME: 2 hours, 30 mins.
INSTRUCTION: Answer any four questions and show the details of all your calculations.

Question 1

(a) Develop a simple algorithm for the Horner's Scheme for representing the generic polynomial $p(x) = a_n x^n + a_{n-1}x^{n-1} + a_1 x + a_0$.

(b) Find $P'(-2)$ of the polynomial equation below using Horner's method.

$$P'(x) = 2x^4 - 3x^2 + 3x - 4.$$

(c) Use bisection method to obtain a root for

$$f(x) = x^3 + 4x^2 - 10,$$

with $a = 1$ and $b = 2$ as the starting point, correct to six *(6)* decimal places. Compute four *(4)* iterations and tabulate your results.

Question 2

(a) If x_0 is an approximate root of $f(x) = 0$ and $x_1 = x_0 + h$ is the correct root such that $f(x_1) = 0$. Prove that

$$x_{n+1} = x_n - \frac{f(x_n)}{f^1(x_n)}$$

(b) i) Draw a flow chart for Newton-Raphson Algorithm.
ii) Write a C program that implements your flowchart in (bi).

(c) Find an approximation to the smallest positive root of the equation

$$x^2 - 4x = -2$$

using fixed point formula with $x_0 = 0$.

Question 3

(a) Compute $f'(2)$ for the equation $f(x) = \sqrt{x}$ using forward and backward difference formulas. Correct to four *(4)* decimal places and compare with exact solution. *Take h =0.1.*

(b) Write a C sub-program to resolve the equation in 3(a).

$f' = xe^x + e^x$

(c) Let $f(x) = xe^x$, use three and five points central difference formulas to find $f'(2)$ if $h = 0.05$. Correct to five *(5)* decimal places and compare with exact solution.

3P = 1

5P = 1.3333

Question 4

4/15

(a) Derive newton's forward difference interpolation formula $y_n(x)$, such that y and $y_n(x)$ agree at tabulated points

(b) Use the table below to find the value of y when $x = 0.638$ using Stirling's formula

x	0.61	0.62	0.63	0.64	0.65	0.66	0.67
$y = e^x$	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

(c) Write a C sub-program to resolve the equation in 4(b).

Question 5

(a) Develop an algorithm for Euler's method.

(b) Given $\frac{dy}{dt} = te^{3t} - 2y$ at $0 \le t \le 1$ where $y(0) = 0$. Compute $y(0.5)$ and $y(1)$ using Euler's method correct to seven *(7)* decimal places.

(c) Given $y' = 1 + y^2$, where $y = 0$ and $x = 0$. Find $y(0.2)$ and $y(0.4)$ Runge-Kutta fourth order formula. Correct to four *(4)* decimal places.

$\frac{d^2y}{d^2x} = \frac{1}{h^2}(\Delta^2 y_{-1}) - \frac{1}{12}\Delta^4 y_{-2}$

Question 6

(a) A function $y = f(x)$ is defined as follows :

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

Compute the values of dy/dx and d^2y/dx^2 at $x = 1.4$ and estimate the errors in the values of dy/dx and d^2y/dx^2. Take $\varepsilon = 0.5 \times 10^{-4}$.

$\frac{dy}{dx}_{x=x_0} = \frac{1}{h}\left(\frac{\Delta y_{-1} + \Delta y_0}{2} - \frac{1}{6}\left(\frac{\Delta^3 y_{-2} +}{2}\right.\right.$

(b) Evaluate

$$I = \int_0^2 \frac{1}{1+x}\,dx$$

using Trapezoidal and Simpson's rules with h = 0.25.

$+\frac{1}{30}\left(\frac{\Delta^5 y_{-3} + \Delta y_{-2}}{2}\right)$

$T_1 = \frac{1}{6h}(\Delta^3 y_{-1} + \Delta y_0)$

(c) write a C program to implement Simpson's rule.

$R_1 = \frac{3\varepsilon}{h}$ 9.6668

$T_2 = \frac{1}{12h}(\Delta^4 y_{-2})$

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF PHYSICAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
2018/2019 FIRST SEMESTER EXAMINATION

COURSE TITLE: NUMERICAL COMPUTATION
COURSE CODE: CSC 271/ CSC 251/ CSC351
TIME: 2 hours, 30 mins.
INSTRUCTION: Answer any four questions and show the details of all your calculations.

QUESTION ONE

(a) Develop a simple algorithm for Bisection method for a solution $f(x) = 0$, given the continuous function f on the interval $[a, b]$, where $f(a)$ and $f(b)$ have opposite signs.

(b) Use bisection method to obtain a root for

$$f(x) = x^6 - x - 1,$$

with $a = 1$ and $b = 2$ as the starting point, correct to four *(4)* decimal places. Compute five (5) iterations and tabulate your results.

c) Find $P'(-2)$ of the polynomial equation below using Horner's method.

$$P'(x) = 2x^4 - 3x^2 + 3x - 4.$$

QUESTION TWO

(a) Write a C-program for Newton-Raphson Method.

(b) Determine the real root of the equation $5sin^2x - 8cos^5x$ using Newton-Raphson method for three *(3)* iterations and correct to five *(5)* decimal places.. N.B: x is measured in radian and $x_0 = 0.5$.

(c) Find an approximation to the smallest positive root of the equation

$$x^2 - 4x = -2$$

using fixed point formula with $x_0 = 0.4$.

QUESTION THREE

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$$y_n(x) = y + p\Delta y_0.$$

(c) Write a C sub-program for Striling Interpolation Formula.

QUESTION FOUR

(a) Let $f(x) = xe^x$, use three and five points central difference formulas to find $f'(2)$ if $h = 0.005$. Correct to five *(5)* decimal places and compare with exact solution.

(b) State Maclaurin's series and obtain the first three *(3)* non-zero terms in the expansion of $\ln(1 + x)$ using Maclaurin's series.

(c) Evaluate $\left(1 + \frac{1}{50}\right)^8$ using Binomial series correct to five *(5)* significant figures.

QUESTION FIVE

(a) A function $y = f(x)$ is defined as follows :

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Compute the values of dy/dx and d^2y/dx^2 at $x = 1.4$.

(b) Evaluate

$$I = \int_0^2 e^x \, dx$$

using Trapezoidal and Simpson rules with h = 0.5.

(c) Write a C program to implement Trapezoidal rule.

QUESTION SIX

(a) Develop a simple algorithm for fourth order Runge kutta formula

(b) Given $y' = y - x^2 + 1$, where $y = 0.5$ and $x = 0$. Find $y(0.2)$ and $y(0.4)$ using Runge-Kutta fourth order formula. Correct to six*(6)* decimal places.

(c) Given $\frac{dy}{dt} = te^{3t} - 2y$ at $0 \le t \le 1$ where $y(0) = 0$. Compute $y(0.5)$ and $y(1)$ using Euler's method correct to five *(5)* decimal places.