



KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER, 2018/2019 ACADEMIC YEAR

**EXAMINATION FOR THE DEGREE OF BSC. IN COMPUTER SCIENCE AND BSC.
INFORMATION TECHNOLOGY**

COMP 121/COMP122: DISCRETE STRUCTURES

STREAM: Y1S2

TIME: 9.00-11.00 AM

EXAMINATION SESSION: JAN-APRIL

DATE: 1/04/2019

INSTRUCTIONS

- Instructions to candidates: Answer **QUESTION ONE** and any other **TWO** questions

QUESTION 1

(30 Marks)

- Use a Truth Table to prove that $\neg q \vee (\neg p \rightarrow (p \leftrightarrow q))$ is a tautology (3 marks)
- Differentiate between Eulerian graph & Hamiltonian graph with example. (4 marks)
- Define the following terms (5 marks)
 - Set
 - Graph
 - Domain
 - Range
 - Postulates
- Draw a K-map for the the following expression: $AB + A'B'$ (3 marks)
- Discuss the two canonical forms in Boolean expression (4 marks)
 - The sum of minterms (SOM) form
 - The product of maxterms (POM) form:

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(1 Peter 3:15)*



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- f. Write the following statement in symbolic form using quantifiers (6 marks)
- (i) All students have taken a course in mathematics.
 - (ii) Some students are intelligent, but not hardworking.
 - (iii) Some people are dishonest
- g. Graph traversal is the problem of visiting all the vertices of a graph in some systematic order. Describe ways one can traverse a graph. (5 marks)

QUESTION 2

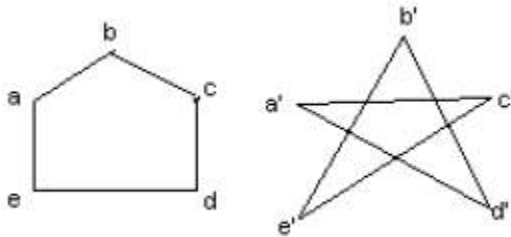
(20 Marks)

- a. Minimize the following Boolean expression using Boolean identities:

$$F(A, B, C) = A'B + BC' + BC + AB'C'$$

(6 marks)

- b. Show that the given graphs are isomorphic. (4 marks)



- c. Describe steps followed while finding the probability (4 marks)
- d. Define duality principle (2 marks)
- e. Explain the two conditions that a finite or infinite set „S“ with a binary operation „0“ (Composition) should hold simultaneously to be called semigroup (4 marks)

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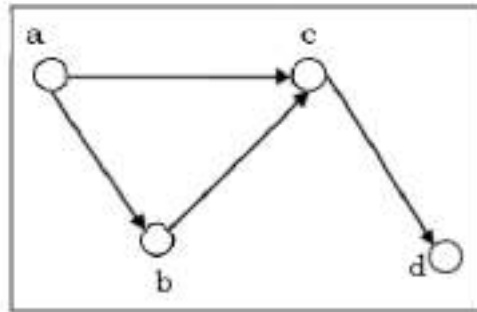
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QUESTION 3

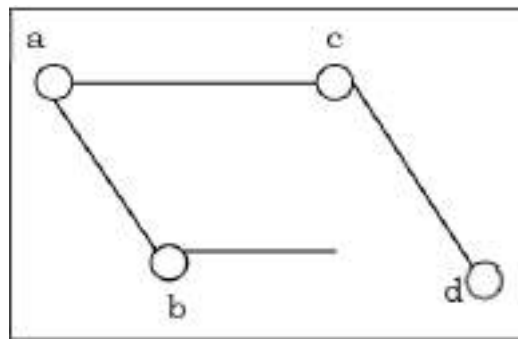
(20 Marks)

- Explain the two way set can be represented (5 marks)
- Let us consider the following graphs and construct their adjacency matrix: (5 marks)

i)



ii)



- Using a truth table describes the five connectives propositional logic use (7 marks)
- Prove $\neg (A \vee B)$ and $[(\neg A) \wedge (\neg B)]$ are equivalent (3 marks)

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QUESTION 4**(20 Marks)**

- a. Let $p(x)$: x is mammal and $q(x)$: x is animal. Translate the following in English
(3 marks)
- $(\forall x)(q(x) \rightarrow (\neg p(x)))$
- b. Describe the following type of set
(5 marks)
- Finite,
 - Subset,
 - universal,
 - Proper,
 - Singleton set
- c. Using combination Find the number of subsets of the set $\{1, 2, 3, 4, 5, 6\}$ having 3 elements
(3 marks)
- d. From a bunch of 6 different cards, how many ways we can permute it? (3 marks)
- e. Represent the following given set using Venn diagram to show an intersection $A = \{11, 12, 13\}$ and $B = \{13, 14, 15\}$, then $A \cap B = \{13\}$. (3 marks)
- f. Discuss the different way Relations can be Representation using Graph (3 marks)

QUESTION 5**(20 Marks)**

- a. (i). Define Bayes' Theorem and state its application areas (4 marks)
(ii). Consider three pen-stands. The first pen-stand contains 2 red pens and 3 blue pens; the second one has 3 red pens and 2 blue pens; and the third one has 4 red pens and 1 blue pen. There is equal probability of each pen-stand to be selected. If one pen is drawn at random, using Bayes' Theorem what is the probability that it is a red pen?
(4 marks)
- b. Let $A = \{1, 3, 5\}$ and $B = \{3, 4, 5\}$ be sets. What is the cardinality of the power set $P(A \cup B)$ (2 marks)
- c. Explain the Degree of a Vertex and describe its formula (2 marks)
- d. Explain the difference between the following broadly categories Mathematics can be classified
(4 marks)
- Continuous Mathematics
 - Discrete Mathematics
- e. A boy lives at X and wants to go to School at Z. From his home X he has to first reach Y and then Y to Z. He may go X to Y by either 3 bus routes or 2 train routes. From there, he can either choose 4 bus routes or 5 train routes to reach Z. How many ways are there to go from X to Z?
(4 marks)

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UNIVERSITY EXAMINATIONS
MAIN CAMPUS

FIRST SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BSC IN COMP SCIENCE /I.T

COMP 121/ COMP 122: DISCRETE STRUCTURES

STREAM: [Y1S2]

TIME: 9.00-11.00PM

EXAMINATION SESSION: DECEMBER

DATE: 7/12/2017

INSTRUCTIONS

- (i) Answer Question one and any other two**
- (ii) Do not write on the question paper**
- (iii) Show your working clearly**

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SECTION A: COMPULSORY

Question One:

[30 Marks]

a) Using examples explain the following terms

i) Discrete structure

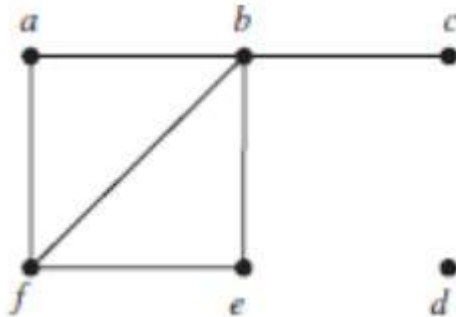
[2marks]

ii) Mathematical Induction

[2marks]

b) Find the number of vertices, the number of edges, and the degree of each vertex in the given undirected graphs. Identify all isolated and pendant vertices.

[4marks]



c) What is set builder notation?, give the builder notation for the following Sets

[4marks]

i) The set of all prime numbers

ii) The Set of all Natural numbers such that $x = x^2$

d) What is $O(N)$ time in recursion

[2marks]

e) Use examples to explain the following types of Set

i) singleton set

[2marks]

ii) universal set

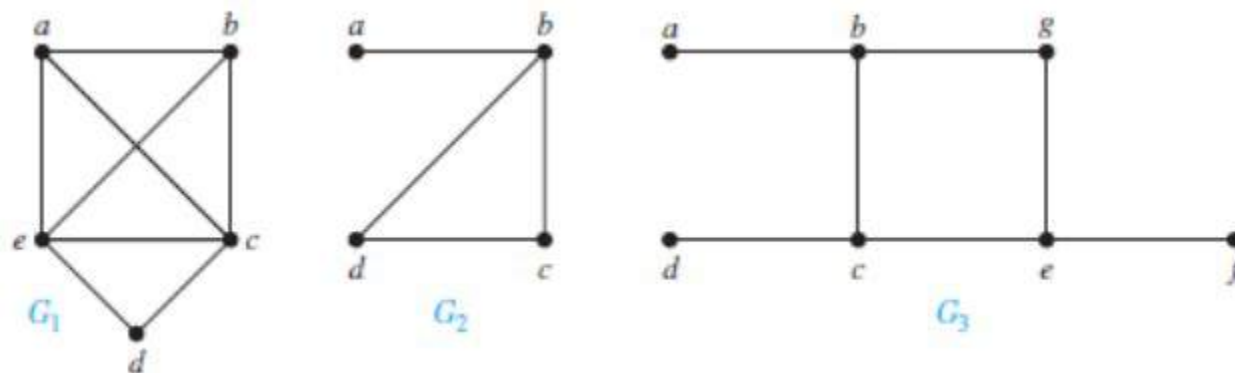
[2marks]

f) In a group of 50 students 24 like cold drinks and 36 like hot drinks and each student likes at least one of the two drinks. How many like both coffee and tea?

[4marks]

g) Which of the graphs have a Hamilton circuit or, if not, a Hamilton path (show your workings)

[4marks]



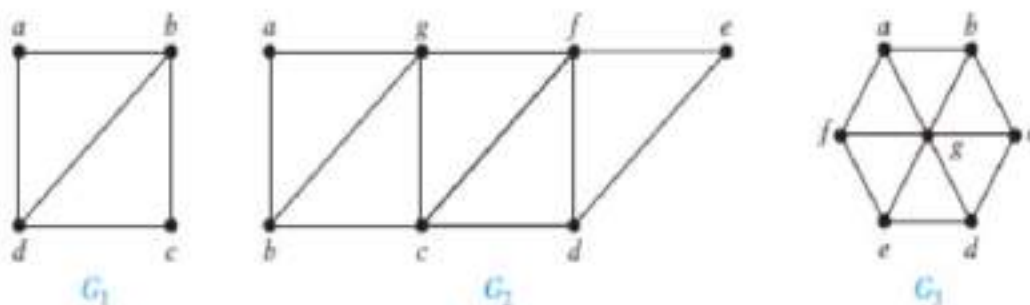
- h) Suppose you are given the bit string for the set $\{1,3,5,7,9\}$ with a universal set $\{1,2,3,4,5,6,7,8,9,10\}$ as 10 10 10 10 10 what is the bitstring of its complement? [4marks]

SECTION B: ANSWER ANY TWO QUESTIONS

Question Two:

20 Marks

- a) Define a Euler path, Which graph is a Euler path below? (show your workings) [5marks]



- b) Use Euclid's algorithm to find the greatest common divisor(GCD) of 245 and 455. [4marks]
- c) Let A be the set of students who live within one mile of Kabarak and let B be the set of students who walk to classes. Describe the students in each of the following set using a Venn diagram [6marks]

i) $A \cap B$

ii) $A \cup B$

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iii) A-B

iv) B-A

d) Using an example describe a prolog program structure

[5marks]

Question Three:

20 Marks

a) Fill in the truth table below to show that $(p \vee q) \wedge ((r \vee \neg q) \vee (q \wedge \neg p))$ is not equivalent to r. [10 marks]

p	q	r	$p \vee q$	$r \vee \neg q$	$q \wedge \neg p$	$(p \vee q) \wedge ((r \vee \neg q) \vee (q \wedge \neg p))$

b) Differentiate between existential quantifiers and universal quantifiers

[2marks]

c) Translate the following sentences into First order predicate logic

i. All purple mushrooms are poisonous

[2marks]

ii. Some politicians are corrupt

[2marks]

iii. You can fool some people all the time

[2marks]

iv. No man is a woman

[2marks]

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Question Four:**[20 Marks]**

a) Translate each of the following statements in to a Venn diagram.

i) All students are lazy [2marks]

ii) Some students are lazy. [2marks]

b) Six good laptops and three defective laptops are mixed up. To find the defective laptops all of them are tested one-by-one at random. What is the probability to find both of the defective laptops in the first two pick? [4marks]

c) Explain the following as used in group theory

i. Associative Laws [2marks]

ii. Commutative Laws [2marks]

iii. Distributive Laws [2marks]

d) What is the Cartesian product of $A = \{x, y\}$, $B = \{a, b, c\}$ [3marks]

e) Describe recursion [3marks]

Question Five**[20 Marks]**

a) Identify each proposition as a tautology, contradiction, or contingency.

i) $(p \wedge q) \rightarrow p$ [2marks]

ii) $p \rightarrow (p \vee q)$ [2marks]

b) A survey of 500 television watchers produced the following information 285 watch Football games. 195 watch Baseball games. 115 watch Basketball. 45 watch Football and Basketball. 70 watch Football and Baseball. 50 watch Baseball and Basketball. And 40 watch all the three kinds of games.

(i) How many people in the survey watch none of the three sports? [2marks]

(ii) How many people watch exactly one of the sports? [2marks]

(iii) How many people watch exactly two of the sports? [2marks]

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c) The following are several arguments. Some are valid and some are not. For the valid ones, state its rule of inference and for the invalid ones mention the reason why you think so.

- i. Today, I will either do my homework or call my friend Jennifer. I did not do my homework. Therefore, I did call Jennifer today. [2 marks]
- ii. If Tom gets his paycheck today and he finds a date, then he will go to the opera tonight. Tom did not get his paycheck today, and he was unable to find a date. Therefore he didn't go to the opera later that night. [2 marks]
- iii. If it is 8 pm., I will eat dinner. If it is 9 pm., I will watch TV. Right now, it is either 8pm. or 9pm. therefore I am either eating dinner or watching TV right now. [2 marks]
- iv. If it is raining, or I have a cold, then I will not go out. Last night I did not go out. Therefore I either had a cold or it was raining outside. [2 marks]
- v) If I finish my homework, I will watch a movie. But, I did not watch a movie last night. Therefore, I did not finish my homework last night. [2 marks]

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UNIVERSITY EXAMINATIONS

MAIN CAMPUS

THIRD SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN

COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN

INFORMATION TECHNOLOGY

COMP 122 / COMP 121: DISCRETE MATHEMATICS

STREAM: Y1S2

TIME: 9.00-11.00AM

EXAMINATION SESSION: AUGUST 2018

DATE: 6/8/2018

VENUE: AUDITORIUM

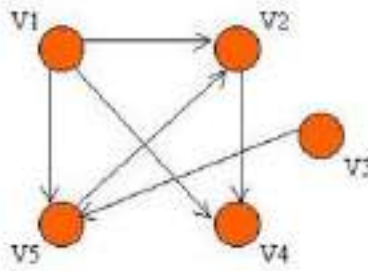
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INSTRUCTIONS:

- Answer Question **ONE** and any other **TWO** Questions. Question One carries 30marks while each of the other Two Questions carry 20marks.
- The **Z80** Instruction set is appended.
- **EXTRA** questions answered will **NOT** be marked

QUESTION 1 (30 marks)

- A. Construct a truth table for the compound proposition $(p \wedge \neg q) \rightarrow (r \vee q)$. 4 marks
- B. Find the adjacency matrix A of the graph G in figure. 4 marks



- C. Define the following terms 6 marks
- The universal quantification
 - The existential
 - Validity of statements
- D. Find the Cartesian product of $A = \{1, 2\}$ and $B = \{a, b\}$? 2 marks
- E. Write each of the following statements in its equivalent contrapositive form: 4 marks
- If my car is in the repair shop, then I cannot go to the market.
 - If Karim cannot swim to the fort, then he cannot swim across the river.
- F. Simplify the following equation using the theorems and postulates of Boolean Algebra: 6 marks

i. $\overline{A(A + B) + BA}$

ii. $F = (A B + B' C) + B (C' + A')$

iii. $\overline{A + B + A * B}$

- G. Describe the difference between standard form (e.g sum of product) and canonical form (e.g sum of minterm)? 4 marks

QUESTION TWO (30 marks)

- A. Propositions can be constructed from other propositions using logical connectives.
Describe the available connectives 8 marks
- B. Find the Cardinality of the Power set of the set $\{0, 1, 2\}$. 2 marks
- C. Discuss the different Representation of Relations used in graphs Graph 4 marks
- D. State and prove the following Tautological implications using Truth Tables: 6 marks
- $[(A \rightarrow B) \wedge A] \rightarrow B$
 - $p \vee \neg p \Leftrightarrow T$
 - $(P \rightarrow Q) \vee (Q \rightarrow P)$

QUESTION THREE (20 MARKS)

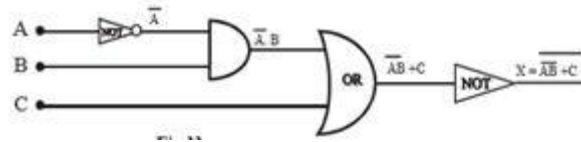
- A. Let R be the relation on the set $\{0, 1, 2, 3\}$ containing the ordered pairs $(0, 1), (1, 1), (1, 2), (2, 0), (2, 2), (3, 0)$. Find the reflexive closure and symmetric closure of R.
4 marks
- B. Identify the component statements and the connective in the following compound statements.
6 marks
- It is raining or the sun is shining.
 - 2 is a positive number or a negative number.
- C. Plot the Boolean expression $\overline{X} = AB + AB + BC$ and minimize expression from the Map.
4 marks
- D. Explain the following principle
6 marks
- Duality principle
 - De-Morgan's theorem

QUESTION FOUR (20 MARKS)

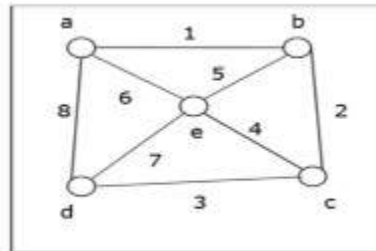
- A. Express the following statements in predicate logic, 6 marks
- Everybody must take a discrete mathematics course or be a computer science student".
 - There are an infinite number of integers.
- B. Describe how Kruskal's algorithm finds a minimum spanning tree for a connected weighted graph. 5 marks
- C. A boy lives at X and wants to go to School at Z. From his home X he has to first reach Y and then Y to Z. He may go X to Y by either 3 bus routes or 2 train routes. From there, he can either choose 4 bus routes or 5 train routes to reach Z. How many ways are there to go from X to Z?
5 marks
- D. Define the following terms 4 marks
- Permutation
 - Degree of a Vertex

QUESTION FIVE (20 MARKS)

- A. Define contradiction and Prove $(A \vee B) \wedge [(\neg A) \wedge (\neg B)]$ is a contradiction 5 marks
- B. Write the Boolean expression that describes mathematically the behavior of logic circuit shown. Use a truth table to determine what input conditions produce a logic 1 output
6 marks



- C. Given the following graph where the (Source vertex is 'a') apply the BFS algorithm to find out the traversal order. 4 marks



- D. Show that $(p \rightarrow q) \wedge (q \rightarrow p)$ is logically equivalent to $p \leftrightarrow q$. 3 marks
- E. Describe what a function is? 2 marks

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MAIN CAMPUS/TOWN CAMPUS

THIRD SEMESTER, 2016/2017 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF

INFORMATION TECHNOLOGY

[COMP 122]: [DISCRETE STRUCTURES]

STREAM: [Y2S1]

TIME: 2 HOURS

EXAMINATION SESSION: AUGUST

DATE: 27/7/2017

INSTRUCTIONS

➤ Instructions to candidates: Answer **QUESTION ONE** and any other **TWO** questions

QUESTION

(30 Marks)

- a. Explain three ways of describing sets. [6 Marks]
- b. i) What is an algebraic system? (2 Marks)
- ii) Briefly describe the five flavours of operations in Algebra. (5 Marks)
- c. What are any six algebraic properties of real numbers x, y and z . (6 Marks)
- d. Differentiate between injective and surjective functions. (4 Marks)
- e. Explain two of the Demorgans Law for Propositions. (4 Marks)
- f. What are the three components of logic ? (3 Marks)

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QUESTION 2**(20 Marks)**

- a. With an elaborate example of a truth table, explain what a tautology is. (5 Marks)
- b. What is the syntax of First Order Logic in BNF? (5 Marks)
- c. Briefly list and explain five particular definitions of homomorphism. (5 Marks)
- d. i) Express “Everyone likes everyone” and “Everyone is liked by everyone” as quantifiers. (3 Marks)
- c. Differentiate between Valued and Non-Valued Graphs. (2 Marks)

QUESTION 3**(20 Marks)**

- a. Given the Group $N = \{A, B, C, D, E, F, G\}$ is a noncommutative group, Calculate the cosets of $M = \{B, D, F, H\}$ which is a subgroup of N . (8 Marks)

#	A	B	C	D	E	F	G	H
A	E	D	F	B	A	C	H	G
B	H	C	G	A	B	D	E	F
C	F	G	E	H	C	A	B	D
D	G	F	H	E	D	B	A	C
E	A	B	C	D	E	F	G	H
F	C	H	A	G	F	E	D	B
G	D	E	B	F	G	H	C	A
H	B	A	D	C	H	G	F	E

- b. Give two examples of Hashing Functions. (4 Marks)

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- c. Differentiate between Disjunctive and Conjunctive Normal Forms. (4 Marks)
- d. What is the truth table for the propositional form $((\neg P) _ Q) \wedge (\neg R)$. (4 Marks)

QUESTION 4

(20 Marks)

- a. Explain the terms; functor, Proper Subset, Venn diagram and Mutually Exhaustive. (8 Marks)
- b. Explain the terms; **Free Variable** and Well **Formulated Formula**. (4 Marks)
- c. Explain the terms; Bijection, Identity, Hash and Recursive as relates to functions. (8 Marks)

QUESTION 5

(20 Marks)

- a. What are the four rules of inference? (8 Marks)
- b. A Boolean algebra is a set S that includes two elements 0 and has two binary operations $+$ and \cdot and has one unary operation $'$ which satisfy the a number of properties for all a, b, c in S . Enumerate the five Properties explicitly. (10 Marks)
- c. What is a contrapositive? (2 Marks)

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UNIVERSITY EXAMINATIONS

MAIN CAMPUS N

FIRST SEMESTER, 2018/2019 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN

COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN

INFORMATION TECHNOLOGY

COMP 122 / COMP 121: DISCRETE MATHEMATICS

STREAM: Y1S2

TIME: 9:00-11:00AM

EXAMINATION SESSION: DEC

DATE: 26/11/2017

VENUE: AUDIT

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INSTRUCTIONS:

- Answer Question **ONE** and any other **TWO** Questions. Question One carries 30marks while each of the other Two Questions carry 20marks.
- The **Z80** Instruction set is appended.
- **EXTRA** questions answered will **NOT** be marked

QUESTION 1 (30 marks)

A. Using examples explain the following connectives In propositional logic 6 marks

- Negation/ NOT (\neg),
- Implication / if-then (\rightarrow),
- If and only if (\Leftrightarrow).

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- B. Define what is a set and describe the two ways set can be represent 3 marks
- C. Draw a graphG for the givenadjacency matrix. 3 marks

	v1	v2	v3	v4	v5
v1	0	1	0	1	1
v2	0	0	0	1	0
v3	0	0	0	0	1
v4	0	0	0	0	0
v5	0	1	0	0	0

- D. Represent the following statement into predicate logic using quantifiers 3 marks
- no cats are reptiles
 - If a thing is a whale, then it's a mammal.
 - Wherever one goes one finds competition.

- E. Describe rules followed while working with duality principle 3 marks

- F. Given the following set $X = \{1, 2, 3, 4, 5, 6\}$ and $Y = \{1, 2\}$. Giving reason determine if the given sets are 3 marks

- Subset
- Proper subset
- Equal set

- G. Simplify the following equation using the theorems and postulates of Boolean Algebra: 6 marks

i. $\overline{A(A+B) + B\bar{A}}$

ii. $F = (A B + B' C) + B (C' + A')$

iii. $\overline{A + B + \bar{A} * B}$

- H. Describe the difference between standard form (e.g sum of product) and canonical form (e.g sum of minterm)? 3 marks

QUESTION TWO

(20 marks)

- A. Explain the following terms as used in discrete mathematics 6 marks

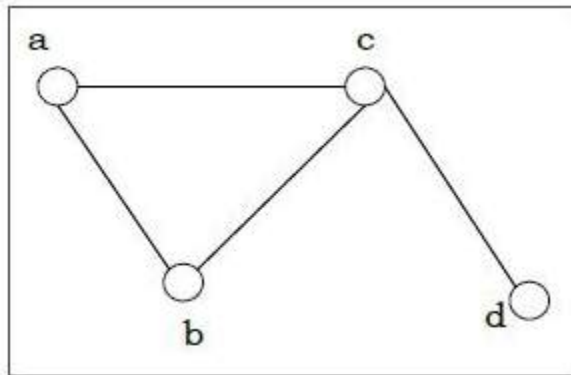
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- i. Contradictions
- ii. Contingency
- iii. Propositional equivalence

B. Considering the given Graph is $G = (V, E)$ where $V = \{a, b, c, d\}$ and $E = \{\{a, b\}, \{a, c\}, \{b, c\}, \{c, d\}\}$



Define and determine

6 marks

- i. Degree of a Vertex
- ii. Degree of a Graph

C. Consider the following conditional statement:

If the flood destroy my house or the fires destroy my house, then my insurance company will pay me.

Write the converse, inverse and contrapositive of the statement. 4 marks

D. Discuss reasoning rules used to prove if an argument form is valid 6 marks

QUESTION THREE (20 MARKS)

- A. Write the following statement in symbolic form using quantifiers: 4 marks
 - i. All students have taken a course in mathematics.
 - ii. Some students are intelligent, but not hardworking.
- B. Let $p(x)$: x is mammal and $q(x)$: x is animal. Translate the following in English: 4 marks

$$(\forall x)(q(x) \wedge (\sim p(x)))$$

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- C. Differentiate between semi group and subgroup with example. 4 marks
- D. Graph traversal is the problem of visiting all the vertices of a graph in some systematic order. Describe ways one can traverse a graph. 5 marks
- E. Find the Cartesian product of $A = \{12, 42, x\}$ and $B = \{y, a, b\}$? 3 marks

QUESTION FOUR (20 MARKS)

- A. Minimize the following Boolean expression using Boolean identities:

$$F(A, B, C) = A'B + BC' + BC + AB'C'$$

6 marks

- B. What do you mean by graph isomorphism, show it by example? 4 marks
- C. Prove if the following three propositions are tautologies: 6 marks
 - i. $p \leftrightarrow p$
 - ii. $p \rightarrow (p \vee q)$
 - iii. $(p \wedge q) \rightarrow (q \wedge p)$
- D. Describe the different application area of Breath First Search 4 marks

QUESTION FIVE (20 MARKS)

- A. Differentiate between Eulerian graph & Hamiltonian graph with example 6 marks
- B. Explain the difference between the following broadly categories Mathematics can be classified 4 marks
 - i. Continuous Mathematics
 - ii. Discrete Mathematics
- C. Describe steps followed while finding the probability 4 marks
- D. Discuss the different Representation of Relations used in graphs Graph 6 marks



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UNIVERSITY EXAMINATIONS
MAIN CAMPUS
SECOND SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF COMPUTER SCIENCE AND
INFORMATION TECHNOLOGY

COMP 122 DISCRETE STRUCTURES

STREAM: [Y2S1]

TIME: 9. 00-11.00 A.M

EXAMINATION SESSION: APRIL

DATE: 12/04/ 2018

INSTRUCTIONS

- Instructions to candidates: Answer **QUESTION ONE** and any other **TWO** questions

QUESTION 1

(30 Marks)

- a. Use a Truth Table to prove that $\neg q \vee (\neg p \rightarrow (p \leftrightarrow q))$ is a tautology (3 marks)
- b. Differentiate between Eulerian graph & Hamiltonian graph with example. (4 marks)
- c. Define the following terms (5 marks)
 - (i) Set
 - (ii) Graph
 - (iii) Domain
 - (iv) Range
 - (v) Postulates
- d. Draw a K-map for the the following expression: $AB + A'B'$ (3 marks)
- e. Discuss the two canonical forms in Boolean expression (4 marks)
 - (i) The sum of minterms (SOM) form
 - (ii) The product of maxterms (POM) form:
- f. Write the following statement in symbolic form using quantifiers (6 marks)

As members of Kabarak University family, we purpose at all times and in all places, to set apart
in one's heart, Jesus as Lord. (1 Peter 3:15)

- (i) All students have taken a course in mathematics.
- (ii) Some students are intelligent, but not hardworking.
- (iii) Some people are dishonest

g. Graph traversal is the problem of visiting all the vertices of a graph in some systematic order. Describe ways one can traverse a graph. (5 marks)

QUESTION 2

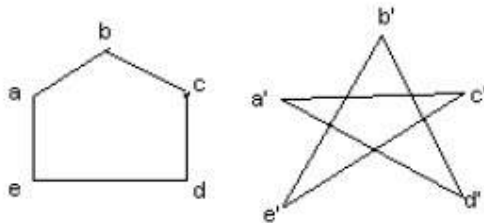
(20 Marks)

a. Minimize the following Boolean expression using Boolean identities:

$$F(A, B, C) = A'B + BC' + BC + AB'C'$$

(6 marks)

b. Show that the given graphs are isomorphic. (4 marks)



c. Describe steps followed while finding the probability (4 marks)

d. Define duality principle (2 marks)

e. Explain the two conditions that a finite or infinite set „S“ with a binary operation „0“ (Composition) should hold simultaneously to be called semigroup (4 marks)

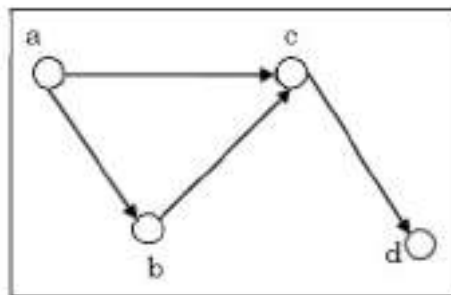
QUESTION 3

(20 Marks)

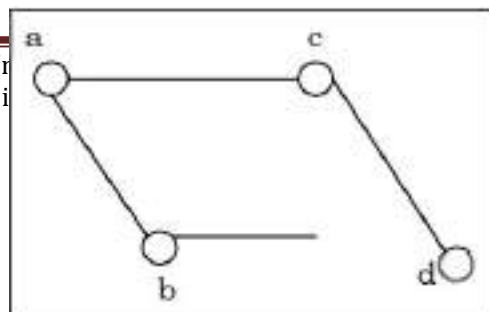
a. Explain the two way set can be represented (4 marks)

b. Let us consider the following graph and construct their adjacency matrix: (4 marks)

(i)



(ii)



As members of Kabarak Un

i

d in all places, to set apart

- c. Using a truth table describes the five connectives propositional logic use (10 marks)
- d. Prove $\neg (A \vee B)$ and $[(\neg A) \wedge (\neg B)]$ are equivalent (2 marks)

QUESTION 4

(20 Marks)

- a. Let $p(x)$: x is mammal and $q(x)$: x is animal. Translate the following in English (3 marks)

$$(\forall x)(q(x) \rightarrow \neg p(x))$$
- b. Describe the following type of set (5 marks)
 - i. Finite,
 - ii. Subset,
 - iii. universal,
 - iv. Proper,
 - v. Singleton set
- c. Using combination Find the number of subsets of the set $\{1, 2, 3, 4, 5, 6\}$ having 3 elements (3 marks)
- d. From a bunch of 6 different cards, how many ways we can permute it? (3 marks)
- e. Represent the following given set using Venn diagram to show an intersection $A = \{11, 12, 13\}$ and $B = \{13, 14, 15\}$, then $A \cap B = \{13\}$. (3 marks)
- f. Discuss the different way Relations can be Representation using Graph (3 marks)

QUESTION 5

(20 Marks)

- a. (i). Define Bayes' Theorem and state its application areas (4 marks)
- (ii). Consider three pen-stands. The first pen-stand contains 2 red pens and 3 blue pens; the second one has 3 red pens and 2 blue pens; and the third one has 4 red pens and 1 blue pen. There is equal probability of each pen-stand to be selected. If one pen is drawn at random, using Bayes' Theorem what is the probability that it is a red pen?

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(4 marks)

- b. Let $A = \{1, 3, 5\}$ and $B = \{3, 4, 5\}$ be sets. What is the cardinality of the power set $P(A \cup B)$ (2 marks)
- c. Explain the Degree of a Vertex and describe its formula (2 marks)
- d. Explain the difference between the following broadly categories Mathematics can be classified (4 marks)
 - i. Continuous Mathematics
 - ii. Discrete Mathematics
- e. A boy lives at X and wants to go to School at Z. From his home X he has to first reach Y and then Y to Z. He may go X to Y by either 3 bus routes or 2 train routes. From there, he can either choose 4 bus routes or 5 train routes to reach Z. How many ways are there to go from X to Z? (4 marks)

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS
MAIN CAMPUS

SECOND SEMESTER, 2016/2017 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF [BSC IN COMPUTER
SCIENCE, BSC IN INFORMATION TECHNOLOGY]

[COMP 122]: [DISCRETE STRUCTURES]

STREAM: [Y2S1]

TIME: 2 HOURS

EXAMINATION SESSION: APR

DATE: 2017

INSTRUCTIONS

Instructions to candidates: Answer **QUESTION ONE** and any other **TWO** questions

QUESTION ONE

30MARKS

- a. Define the terms; **Subsemigroup, Submonoid** and **Lagranges Theorem** [6 Marks]
- b. Construct a truth table for the compound proposition $(p \wedge \neg q) \rightarrow (r \vee q)$. [4 Marks]
- c. Explain the following terms; Declarative Statement, Proposition, Connectives and Truth Tables [8 Marks]
- d. Let $A = \{a, b, c, d\}$ and let $R = \{(a, b), (b, c), (c, d), (d, b)\}$ be a relation on A. Draw the directed graph representing R. [3 Marks]
- e. What is the Syntax of First-Order Logic in BNF [5 marks]
- f. i) Briefly explain what a bijection function is? [2 Marks]
ii) What is a predicate? [2 Marks]

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a. For the following sentence:

The statement that all statements are sentences but not all sentences are statements is false.

(i) Determine if it is a statement; [4 marks]

(ii) If it is a statement, determine whether it is true or false, giving reasons for your answer.

[4marks]

b. What is the truth table for the propositional form $((\neg P) _ Q) \wedge (\neg R)$. [4 Marks]

c. Define the two terms **set** and **Group**. [4 Marks]

d. With symbols, differentiate between a Null set and an Empty set. [4 Marks]

QUESTION THREE

20MARKS

a. i) What are the two Demorgan's Laws for propositions? [4 Marks]

ii) Define the terms **tautology** and **contradiction**. [4 Marks]

b. What is meant by an **ordered pair**? [2 marks]

c. Explain what is a **disjoint pair** [2 marks]

d. What is meant by a function from A to B.? [3 marks]

e.i) The term permutation is used in Linear Algebra, what does it mean? [2 marks]

ii) Enumerate three components of a logic. [3 Marks]

QUESTION FOUR

20MARKS

a. Define the terms; Semigroup, Monoids and Homomorphism. [6 Marks]

b. i) What is an algebraic system? [3 Marks]

ii) What is a function? [3 Marks]

c. Explain any two quantifiers in Predicate Calculus. [4 Marks]

d. Enumerate any four basic algebraic properties of real numbers. [4 Marks]

QUESTION FIVE

20MARKS

a. What is meant by the following terms?

(i) A graph [2 marks]

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- (ii) A simple graph [2 marks]
- (iii) A simple path [2 marks]
- b. i) State three rules of Universal Instantiation and Universal Generalization. [3 Marks]
- ii) Explain the term Partial Ordering. [2 Marks]
- c. Explain the following functions; Hashing , Recursive and Permutation. [6 Marks]
- d. If $X = \{1, 3, 5, 7\}$, $Y = \{2, 3, 5\}$ and $Z = \{1, 5, 7\}$ find
- (i) $X \cap Y$
- (ii) $X \cup Y$
- (iii) $(X \cap Z) \cup Y$ [3 Marks]