KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: COMP 122

COURSE TITLE: DISCRETE STRUCTURE

STREAM: Y1S2

DAY: WEDNESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 16/03/2011

INSTRUCTIONS:

NOTE: - PART-A IS COMPULSORY, HAS 30 MARKS AND FROM PART-B, YOU CAN ATTEMPT ANY TWO QUESTIONS. EACH QUESTION HAS 20 MARKS.

PLEASE TURN OVER

PART-A

QUESTION ONE (MAXIMUM MARKS 30)

a) Rewrite the following statements using set notation:
- i) the element 1 is not a member of A
- ii) A is a subset of C — Marks 2

b) Let p: Amman is in Nakuru and q: 2+2=5
- i) What is the proposition $p \wedge \neg q$?
- ii) What is the value of $p \wedge \neg q$?
- iii) What is the proposition $\neg p \vee \neg q$?
- iv) What is the value of $\neg p \vee \neg q$? — Marks 4

c) List the elements of the following sets; here N= {1, 2, 3……}.
- i) C = { x: x ∈ N, 4+x = 3}
- ii) A = { x: x ∈ N, x^2 + 1 = 10}
- iii) B = { x: x ∈ N, x is odd, -5 < x < 5} — Marks 3

d) Prove the following equivalences by drawing the truth tables
- i) $\neg p \vee \neg q \equiv \neg(p \wedge q)$
- ii) $p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$ — Marks 2

e) The difference of two propositions is defined by p-q≡ $p \wedge \neg q$ .prove that

$$p \to q \equiv \neg(p - q)$$ Marks 2

f) Consider the sets :{4, 2}, {x: x^2 -6x + 8=0}, {x: x∈ N, x is even, 1<x<5}.
Which of them are equal to B = {2, 4}? — Marks 2

g) Convert these binary numbers to decimal.
- i) 101010
- ii) 101001000 — Marks 3

h) Let A={1,2,3,4,5}, B={0,2,4,6} and C={1,3,5}. Find the following set.
- i) $(A \cup C) \oplus (A \cap C)$
- ii) $A \oplus (B \cup C)$
- iii) $(A \oplus B) - (A \oplus C)$
- iv) $(A - B) \oplus (A - C)$ — Marks 4

i) Suppose A = {1, 2}. Find A^3 — Marks 2

j) A class consists of seven men and five women. Find the number m of committees of five that can be selected from the class. — Marks 2

k) Determine the power set P(A) of A={x, y, z, p} — Marks 4

Question 2

a) How many positive integers ≤ 200 are multiples of

i) 3 or 5?

ii) Not multiples of 2 or 17? Marks 2

b) Suppose that A= {1,2,3,4}, B= {2,3,4,5,6,7}, C= {3,4}, D= {4,5,6}and E= {3}

1. Which of the five sets can equal X if X$\subseteq$A and X$\subseteq$B?
2. Which of the five sets can equal to X if X$\not\subset$D and X$\subseteq$C?
3. Find the smallest set M which contains all five sets.
4. Find the largest set N which is a subset of all the five set. Marks 4

c) Draw a Venn diagram of sets A, B, C where A and B have elements in common, B and C have elements in common, but A and C are disjoint. Marks 2

d) True or false? Use the Venn diagrams to verify each one.

i) $(A \cup B) - (A \cap B) = A \oplus B$

ii) $(A \oplus B) - B = A$ Marks 3

e) Suppose U={1,2,3,……..8,9},A= {1,2,3,4}, B={2,4,6,8}, and C={3,4,5,6}. Find

(i) $(A \cup B) \cup C$ and (ii) $A \cup (B \cup C)$ Marks 4

f) Determine which of the following sets are finite.

(i) A={seasons in the year}

(ii) B= {state in the union}

(iii) C={+ve integers less than 1} Marks 3

g) Convert these decimal numbers to binary.

i) 37

ii) 99 Marks 2

Question 3

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

i) $(p \wedge q) \rightarrow p$ Marks 2

ii) $p \rightarrow (p \vee q)$ Marks 2

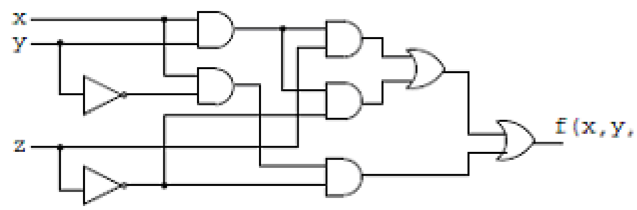
b) Draw the logic circuit diagram of the expression

$x \cdot y = \overline{\overline{x} + \overline{y}}$.

c) i) Find out the expression from the logic circuit diagram. Marks 2

ii) Convert the expression into minimal form. Marks 4

iii) Draw the logic circuit diagram of the minimal expression Marks 2



d) Find the number of distinct permutations that can be formed from all the letters of each word
  I. THEM; and
  II. THAT Marks 2

e) Draw the truth table of the following
  ii. $\neg p \vee \neg q$ Marks 2
  iii. $\neg(p \wedge q) \rightarrow p$ Marks 2

f) Describe the " arrow diagram" of a relation R from a finite set A to a finite set B. Illustrate using the relation R from set A ={1,2,3,4} to set B = {x, y, z}defined by R = {(1,y),(1,z),(3,y),(4,x),(4,z)} Marks 2

Question 4

a) How many different permutations are there of the elements taken from:
  i. The multiset {A, B,B,C}?
  ii. The word DISCRETE?
  iii. The word MATHEMATICS?
  iv. The word UNUSUAL? Marks 4

b) How many integer solutions of x + y + z = 11 with each given condition?
  i) x, y, z are non-negative.
  ii) x, y, z are positive. Marks 2

c) One hundred students were asked whether they had taken courses in any of the three areas, sociology, anthropology, and history. The result was:
45 had taken sociology
38 had taken anthropology
21 had taken history
18 had taken sociology and anthropology
9 had taken sociology and history
5 had taken history and anthropology and
23 had taken no courses in any of the area.

(i) Draw a Venn diagram that will show the results of the survey. Marks 4
(ii) Determine the number k of students who had taken classes in exactly (1) one of the areas, and (2) two of the areas. Marks 2

d) Suppose U={1,2,3,……..8,9},A= {1,2,3,4}, B={2,4,6,8}, and C={3,4,5,6}.

Find
(i) A^c
(ii) B^c
(iii) A\B
(iv) B\B

Marks 4

e) Let R be the relation from A = {1, 2, 3, 4} to B = {x, y, z} defined by
R = {(1, y), (1,z),(3,y),(4,x),(4,z)}
(i) Determine the domain and range of R
(ii) Find the inverse relation R^{-1} of R.

Marks 2

f) In a group of 5 men and 5women, four people will be chosen. Find the probability of each event given below.
i) All four are women
ii) Equal number of men and women

Marks 2

Question 5

a) Consider the following three relations on the set A= {1,2,3}:
R= {(1,1),(1,2),(1,3),(3,3)}
S = {(1,1),(1,2),(2,1),(2,2),(3,3)}
T = AXA
(i) Determine which of the relations are reflective.
(ii) Determine which of the relations are symmetric.

Marks 2

b) Convert these zero-one matrices to digraphs.

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

Marks 3

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

Marks 3

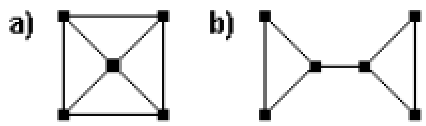
c) Use a K-map to find the prime implicates and minimal form for each of the following complete sum-of-products Boolean expressions.
E_1=xyz + xyz’ + xy’z + x’yz + x’y’z

Marks 3

d) Design a three-input minimal AND-OR circuit L that will have the following truth table:
T= [x=00001111, y= 00110011, z= 01010101, L= 11011001

Marks 7

e) Are these graphs Euler path/circuit?



Marks 2