



Department of Basic Sciences  
Discrete Math II - Second Exam - Semester (2) - 2017/2018

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Name:

Student's Number:

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1. Consider the Boolean function  $F(x, y, z) = \bar{x}(\bar{x} + yz) + \overline{xy}$ .

a. Find the complement function  $\bar{F}(x, y, z)$  of  $F$ . [1]

b. Find the duality function  $F^d(x, y, z)$  of  $F$ . [1]

c. Use identity approach with detailed steps to show that  $F(x, y, z) = \bar{x} + \bar{y}$ . [2]

d. Represent  $F(x, y, z)$  as the sum of products. [2]

2. Find  $F(x, y)$  as a Boolean function of  $x$  and  $y$ , given that [2]

$$F(1, 1) = 0, F(1, 0) = 1, F(0, 1) = 1, F(0, 0) = 0.$$

3. A digraph  $G$  with ordered set of vertices  $\{a, b, c, d\}$  has adjacency matrix given by

$$A_G = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix}.$$

Answer the following questions showing your explanation.

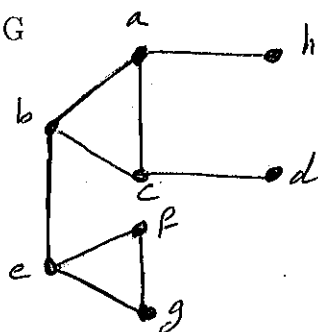
a. Is the graph simple or multiple? [1]

b. Is the graph weakly connected? [1]

c. Is the graph strongly connected? Find the number of strongly connect components. [3]

d. What is the length of shortest path from  ~~$d$~~  <sup>$a$</sup>  to  $c$ , and how many such paths? Give your answer using  $A_G$ . [2]

4. Consider the graph  $G$



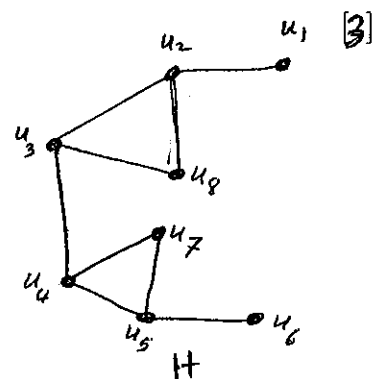
a. Find the cut vertices of this graph.

[1]

b. Find the cut edges of this graph.

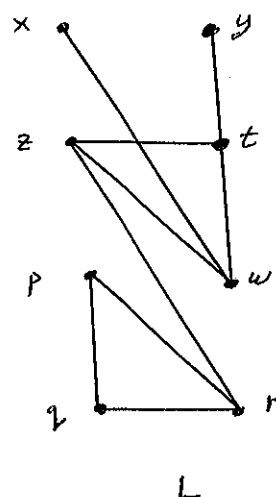
[1]

c. Give a reason why  $G$  is not isomorphic to the graph  $H$  given by



d. Show that  $G$  is isomorphic to the graph  $L$  given by

[3]



5. Let  $G$  be a simple undirected graph whose adjacency matrix contains a row with all entries are zeros. Show that the complement graph  $\bar{G}$  is connected. [2]

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Extra Space