SIR ARTHUR LEWIS COMMUNITY COLLEGE

ACADEMIC YEAR (2024/2025) – SEMESTER ONE

END OF SEMESTER EXAMINATION

COURSE CODE : **MAT234**

COURSE TITLE : **Discrete Mathematics I**

LECTURER(S) : **Allison Drysdale-Felix**

DATE : **18th December 2024**

TIME : **1 p.m. – 3 p.m.**

DURATION : **2 hours**

STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

- Students must sign **IN** and **OUT** on the examination class list.
- Write your ID number on the question paper.
- There are five (5) questions on five (5) pages.
- Answer ALL questions in the space provided using **BLUE** or **BLACK** ink

Question	Student's mark	Max score
1		7
2		8
3		10
4		14
5		19
Total		58

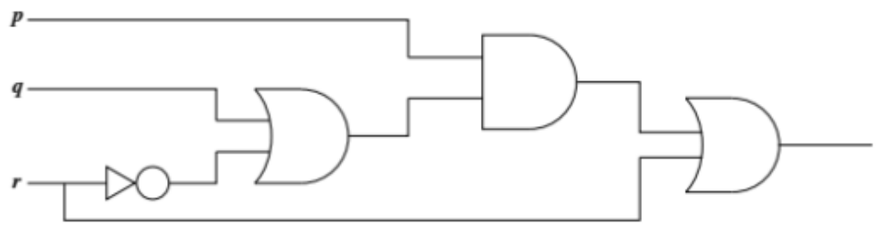
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1.

a. Draw the switching circuit for $(p \vee q) \wedge (\sim p \vee \sim q)$

[3]

b. Write the Boolean expression for the following logic circuit



[4]

2.

(i) Let p and q be any two propositions. Complete the truth table below.

p	q	~q	(~q ∧ p)	p ∨ (~q ∧ p)
T	T			
T	F			
F	T			
F	F			

[3]

(ii) Hence, state whether the statements $(\sim q \wedge p)$ and $p \vee (\sim q \wedge p)$ are logically equivalent. Justify your response.

[2]

(iii) For the statement " If I live in St. Lucia, then I can swim" write the following

a. Converse _____

b. Inverse _____

c. Contrapositive _____

[3]

3. The table below shows the cost, in dollars, of transporting an item from warehouses W_1, W_2, W_3 and W_4 to supermarkets S_1, S_2, S_3 and S_4 .

	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$
$\mathbf{W_1}$	6	5	7	9
$\mathbf{W_2}$	2	6	5	8
$\mathbf{W_3}$	10	5	1	9
$\mathbf{W_4}$	11	6	3	8

(i) Use Hungarian algorithm to determine the supermarket to which EACH warehouse must be assigned in order to MINIMIZE the cost of delivery. [8]

(ii) Hence, determine the total cost for EACH item at the four warehouses. [2]

4. An established company has decided to add a new product to its line. It will buy the product from a manufacturing outlet, package it and sell it to a number of distributors that have been selected on a geographical basis. Market research has already indicated the volume expected and the size of sales force required. The activities shown in the following table are to be planned.

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate predecessors	–	–	–	A	B	B	C	E	D	F,G	H,I
Duration (Days)	4	7	3	6	4	7	6	10	3	4	2

(i) Construct the activity network for the project. Use the activity by arc method. [6]

(ii) Complete the following table which shows the earliest and latest start time for each activity.

Activity	Earliest Start Time	Latest Start Time	Float
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

[4]

(iii) Determine the critical path for this activity network

[2]

(iv) State the minimum time to complete the project.

[2]

5. A small brewery produces Drink A and Drink B. To make Drink A, 5 kg of corn, 4 kg of hops and 35 kg of malt are required. To make Drink B, 15 kg of corn, 4 kg of hops and 20 kg of malt are required. Only 480 kg of corn, 160 kg of hops and 1190 kg of malt are available. The brewery makes a profit of $130 for each kg of Drink A and $230 for each kg of Drink B.

(i) Using x to represent the amount of Drink A to be produced and y to represent the amount of Drink B to be produced, determine the inequalities of the constraints that must be satisfied by the variables. [4]

(ii) State the objective function that represents the maximized profit. [2]

(iii) Plot the graph to represent EACH of the inequalities. **Shade** the feasible region that satisfies ALL the constraints on the graph plotted. [7]

(iv) Determine the amount of Drink A and the amount of Drink B that the brewery must produce to maximize its profit. [6]