CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE

COLLEGE OF NATURAL AND APPLIED SCIENCES

B.Sc. EXAMINATION HARMATTAN SEMESSTER 2019/2020 SESSION

CSC313: OPERATIONS RESEARCH

TIME ALLOWED: $2^{1}/_{2}$ HOURS

INSTRUCTIONS: **ANSWER 4 QUESTIONS ONLY**

1.. A retired worker has a poultry house with a maximum capacity of 1000 birds where he plans to raise turkey, cockerels and egg laying hens. The table below shows cost of raising each bird to maturity as well as the profit per unit. The total cash available for raising the birds is 2,250,000 naira. The objective is to maximise the profit on the condition that the number of hens should not be less than 300.

Bird	Unit Raising Cost	Unit profit
Turkey	7,500	3,000
Cockerel	1,500	700
Hen	1000	400

i. Define the LP Model (4marks)
ii. Use the simplex method to obtain the optimum point (7marks)
iii. From your simplex tableau state the profit and the number of each bird at optimum.(4marks)

2 (a) What is a slack variable ?(1 mk)

b)Consider the following LP problem:

Maximise $5x_1 + 9x_2 + 7x_3$

Subject to: $x_1 + 3x_2 + x_3 \leq 36$;

$x_1 + 6x_2 + 4x_3 \leq 120$;

$x_i \geq 0$, i=1,2,3

(i) Use the simplex method to find the optimum. (10 mks)

(ii) From your simplex tableau state the optimum values for x_1, x_2, x_3, Z (4 mks)

3. A linear programming problem is stated as;

Minimise $Z = 6x_1 + 5x_2$

Subject to; $5x_1 + 3x_2 \geq 60$

$7x_1 + 9x_2 \geq 126$

$X_1 + x_2 \geq 15$

(i) Determine the dual of the problem. (4 marks)

(ii)Solve the dual of the problem by simplex method. (8mks)

(ii) State values of Z, x_1, x_2 at the optimum value. (3marks)

4. An L. P. model was stated as;

Minimise $Z = 3x_1 + 5x_2$

Subject to: $x_1 \leq 4$;

$2x_2 \leq 12$;

$3x_1 + 2x_2 \leq 18$;

$X1 + x2 \geq 5$;

$x_1 \geq 0, x_2 \geq 0$

i. List the decision variables in this model. (1mks)

ii. State the objective function. (1mk)

iii. State the constraints (2 mks)

iv. Determine the optimal solution using the **graphical method**, stating clearly the optimal values of x_1, x_2 and Z. (11 mks)

5.. Dangote Cement Company of Nigeria produces cement at 2 factories located at Ibese and Obajana. The daily production at the factories are 1.5 million and 1 million bags respectively. The major distribution centers are located at Lagos, Onitsha, Kaduna, Kano, PH and Benin where the daily demands are 850,000, 500,000, 300,000, 400,000, 250,000 and 200,000 bags respectively. The cost in naira of delivery per bag from each factory to each distribution center is shown in the table below.

FACTORY	DISTRIBUTION CENTER					
	LAGOS	ONITSHA	KADUNA	KANO	PH	BENIN
IBESE	100	140	240	300	200	130
OBAJANA	130	180	120	160	250	170

i. Determine if this is a balanced transport problem. (1mk)

ii. Determine the initial basic feasible solution by North West method. What is the transportation cost?(4 mks)

Iii. Determine the initial basic feasible solution by the least cost method. What is the transportation cost?(5mks)

iv. Determine the initial basic feasible solution by Vogel's approximation method. Calculate the transportation cost. (5mks)

6 The sales manager of a company that distributes office equipment has 4 sales reps to whom he must assign one sales area each to cover the Lagos metropolis. The table below shows the likely average monthly sales in millions of naira for each area when handled by different reps.

Reps	Lagos Island	Ikeja	Surulere	Ikorodu
Olu	70	41	52	48
Ife	46	36	38	50
John	44	42	34	38
Dan	41	28	40	36

i. Determine the optimum assignment of the areas to reps for maximum total sales (13 marks)

ii. Calculate the total monthly sales in millions of naira for the company at optimum. (2mks)

End