COURSE CODE: 4205
COURSE TITLE: OPERATIONS RESEARCH   **TIME: 2 ½ HRS**
INSTRUCTION: Answer any four questions. Show sufficient detail of working

Q.1   A small company builds two types of garden chairs, A and B. Type A requires 2 hours of machine time and 5 hours of craftsman time. Type B requires 3 hours of machine time and 5 hours of craftsman time. Each day there are 30 hours of machine time available and 60 hours of craftsman time. The profit on each type A chair is ₦60 and on each type B chair is ₦84. Formulate the appropriate linear programming problem and solve it graphically to obtain the optimal solution that maximizes profit.

Q.2   Solve the LP below by Simplex method in tabular form:

Maximize Z = $2X_1 + X_2$

Subject to: $X_2 \leq 10$

$$2X_1 + 5X_2 \leq 60$$

$$X_1 + X_2 \leq 18$$

$$3X_1 + X_2 \leq 44$$

$$X_1\ X_2 \geq 0$$

Table Q.3

		T1	T2	T3	T4	T5
	A	45	60	75	100	30
	B	50	35	40	100	45
Persons	C	60	70	60	110	40
	D	30	20	60	55	25
	E	60	25	65	185	35

Tasks (column header group spanning T1–T5)

Table Q.4

From \ To	A	B	C	Capacity
D	5	4	3	100
E	8	4	3	300
F	9	7	5	300
Requirements	300	200	200	

Q.3 Five tasks are to be assigned to five people. The costs in naira (₦) are set out in the matrix of Table Q.3 above. Use the Hungarian method to determine the assignments which will minimize the total cost if each task can be assigned to one and only one person.

Q.4 Consider the transportation problem in which the cost, supply and demand values are presented in Table Q.4 above

(a) Is this a balanced problem? Why?

(b) Obtain the initial feasible solution using the North-West Corner rule.

Q.5 (a) In the context of, OR, define the following: (i) Basic feasible solution (ii) Slack variable (iii) Surplus variable (iv) Degeneracy (v) Unbounded solution (vi) Infeasible solution

(b) Give one practical example of an Unbalanced Assignment problem. Show how such a scenario can be balanced.

Q.6 (a) What is the importance of scientific inventory management?

(b) Explain the following terminologies associated with inventory keeping: (i) Deterministic model (ii) Stochastic model (iii) Holding cost (iv) Set up cost (v) Purchase cost (vi) EOQ

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Q.1   A company produces two fruits packages. Package A contains 20 peaches, 10 pears. Package b contains 10 peaches, 30 apples and 12 pears. 40,000 peaches, 60,000 apples and 27,000 pears are available for packaging. The profit on package A is ₦2.00 and the profit on B is ₦2.50. Assuming that all fruits packaged can be sold, graphically determine the number of packages of types A and B that should be produced to maximize the profit. What is the maximum profit?

Q.2   Solve the LP below by Simplex method in tabular form:

Maximize Z = $2X_1 + X_3$

Subject to: $3X_1 + X_2 + X_3 \leq 60$

$$X_1 - X_2 + X_3 \leq 10$$

$$X_1 + X_2 - X_3 \leq 20$$

$$X_1, X_2, X_3 \geq 0$$

Q.3   Solve the following assignment problem (Table Q.3) using the Hungarian method.

Table Q.3

Men→ Job	M1	M2	M3	M4
J1	18	25	14	23
J2	15	38	23	53
J3	17	15	30	42
J4	28	26	29	36

Table Q.4

From \ To	P1	P2	P3	Capacity
C1	5	8	12	300
C2	7	6	10	600
C3	13	4	9	700
C4	10	13	11	400
Requirements	700	500	800	

Q.4 A construction company wants cement at three of its project sites P1, P2 and P3. It procures cement from four plants C1, C2, C3 and C4. Transportation costs per ton, capacities and requirements are shown in Table Q.4. Use the North-West corner rule to find the initial feasible solution of the problem.

Q.5(a) Define Operations Research (OR) and mention three main components of an OR mode.

(b) Explain what these components mean with illustrative examples.

(c) In the context of OR, explain what you understand by: (i) Basic feasible solution (ii) Slack variable (iii) Surplus variable (iv) Degeneracy (v) Unbounded solution (vi) Infeasible solution

Q.6(a) Compare unbalanced Transportation and unbalanced Assignment Models with examples. How can these be balanced?

(b) Name any 3 methods of solving each.

(c) How do optimally test differ for both models?

(d) name 4 basic assumptions of the TP model.