Unity University

Faculty of Distance and Continuing Education

Department of Management

Work sheet for **Operation Research (Mgmt. 411)**

Name _____

Id No. _____

Department _____

Student Center _____

Program: Distance ☐

Regular / Extension ☐

This is a work sheet you are expected to do by your own. It carries 25 marks. The work sheet should be completed and submitted to your center coordinator which will be sent to the Head Office of the School of Distance and Continuing Education for evaluation. Do not try to complete the worksheet until you have covered all the lessons and exercises in the course material.

Any questions in the course that you have not been able to understand should be stated on a separate sheet of paper and attached to this work sheet. Your tutor will clarify for you.

After completing this worksheet, be certain to write your name, Id No and Address on the first page. In addition to this, *your Name and Id No should be written on each paper of the work sheet.*

***N.B:* This worksheet has 3 parts and 4 pages. Good work!**

PART I: TRUE OR FALSE QUESTIONS (4 marks)

Write "true" if the statement is correct and "false" if the statement is not correct on the answer sheet provided (0.5marks each)

1. The dual to given linear programming problem would have as many variables as the number of variables in the primal.
2. A job assignment problem is restricted when each of the given workers can do each of the given jobs
3. The north west corner method of finding initial feasible solution take in to account the cost of moving a unit of item from origin to destination
4. The simplex method of searching optimal value is basically algebraic method.
5. In order to decide upon the incoming variable in a maximization non optimal simplex tableau, we select the variable corresponding with the smallest replacement ratio.
6. Linear programming solutions may include a sensitivity report which gives information on making changes in objective function coefficients.
7. The critical path of a project network represents the maximum time needed to complete the project.
8. In maxmin strategy decision criterial is selecting the worst of the best.

Part II Multiple choice (8marks)

Choose the best answer and write the letter of your answer on the answer sheet attached (0.5 Point each)

1. A special situation in linear programming problems whereby it is not possible to get value to the objective function whether it is maximization or minimization problem is:
   A. Alternative solution
   B. Unbounded solution
   C. Redundant constraint
   D. Infeasibility situation
2. Special transportation problem where by the number of occupied cell is less than the sum of origins and destinations minus a unit is :
   A. Degeneracy B. Alternative optimal solution C. Redundancy D. Unaccepted routes
3. Assignment problem are a type of problem intended to create a relationship. What type of relationship is expected to undertake using the assignment model?
   A. One –to- one B. One-to-many C. Many- to-one. D .Many –to- many

4. In minimization linear programing problems _____ are assigned to the artificial variables as their coefficients in the objective function.

   A. Zero B. + M C. -M D. +1

5. Which of the following is the standard format of the constraint $-8X_1-6X_2+4X_3 \geq -1200$ if the objective is maximization

   A. $-8X_1-6X_2+4X_3 \geq 1200 - S_i$
   C. $8X_1+6X_2-4X_3 \geq -1200 + S_i$
   B. $8X_1+6X_2-4X_3 \leq 1200+ S_i$
   D. $8X_1+6X_2-4X_3 \geq 1200- S_i$

Refer to the following LP model and its final answer to answer questions 6 to 10

Maximize $Z = 160X_1 + 200X_2$ (Profit)

Subject to:

$2X1 + 4X2 \leq 40$ (Labor Hours)
$18X1 + 18X2 \leq 216$ (Meters of Wood)
$24X1 + 22X2 \leq 240$ (M^3 of Storage Space)
$X1, X2, \geq 0$

The final (optimal) tableau of this problem is given below

Basis	Cj	160 X1	200 X2	0 S1	0 S2	0 S3	Quantity
X2	200	0	1	½	-1/18	0	8
X1	160	1	0	-1/2	1/9	0	4
S3	0	0	0	6	-2	1	48
	Zj	160	200	20	20/3	0	**Z_{max}=?**
	Cj-Zj	0	0	-20	-20/3	0	

6. To change the above model in to standard format , we can:

   A. Add slack variable
   C. Add surplus variable
   B. Subtract surplus variable
   D. Subtract artificial variable

7. The value of objective function($\mathbf{Z_{max}}$) and the shadow price of wood constraint respectively are :

   A. \$48 & \$ 200 B. \$ 2,240 & \$ 20 C. \$2,240 & \$20/3 D. \$48 & \$ 8

8. Which of the following is among the solution to the dual to this LPP?

   A. \$160 B. \$ 20 C. \$ 200 D. all

9. The range of feasibility for wood constraint and the range of optimality for X_2 respectively:

   A. 180 to 240 & 160 to 320
   C. 32 to 48 & 160 to 320
   B. 32 to 48 & 100 to 200
   D. 24 to 48 & 120 to 280

10. If the company needs securing additional unit of only one resource, which one should be?

    A. labor hours B storage space C. Wood D. None

11. The existence of a zero value in Cj-Zj row for decision variable which is **NOT** part of the basic variable indicates:

A. The solution is degenerate
C .The introduction of artificial variable
B. The existence of alternate solution
D. The existence of infeasible solution

Given the following information answer question 12 to 14

Consider the following pay-oof matrix develop by a Marketing manager of a company birr million

Apartment type	Demand Situation		
	High	Medium	Low
One bed room	20	15	10
Two bed rooms	25	25	5
Three bed rooms	40	20	-10

12. One bed room and two bed rooms respectively are the best under which of the following decision criterion?

A. Maximin and Mini max regret
C. Heuristic with $\alpha = 0.6$
B. Minimax and equally likely
D. Both A and B

13. Assuming Heuristic with $\alpha = 0.6$ which apartment should be selected?

A. One bed room
C. Three bed rooms
B. Two bed rooms
D. All bed rooms

14. If the chance of occurrence of the demand situations is predicted to be 50%, 30% and 20% for high, medium and low demand respectively what is the value of perfect information (EVPI)?

A. 5.5 million B. 4.5 million C. 3.5 million D. 4 million

15. The longest path in PERT/ CPM a project network is:

A. Earliest finish time
C. Critical path
B. Optimistic time
D. Latest finish time

16. Special situation of a transportation problem where by 0(zero) value of the net evaluation of unoccupied cells in the final table indicates:

A. Degeneracy
C. Alternate optimal solution
B. Maximization problem
D. Unaccepted routes

Answer sheet for Par I and Part II

Part I: True or False		Part II: Multiple Choice			
1_____	5_____	1_____	5	9_____	13_____
2_____	6_____	2_____	6_____	10_____	14_____
3_____	7_____	3_____	7_____	11_____	15_____
4_____	8_____	4_____	8_____	12_____	16_____

Part III: Workout (13 marks)

Solve the following on separate sheet of paper, attached it and send for correction

Problem 1: A project consists of nine activities whose time estimates (in weeks) and other characteristics are given below (**8 pts**)

Activity	**Preceding activity(ies)**	**Time estimates (weeks)**		
		Most Optimistic	***Most likely***	***Most Pessimistic***
A	-	2	4	6
B	-	6	6	6
C	-	6	12	24
D	A	2	5	8
E	A	11	14	23
F	B,D	8	10	12
G	B,D	3	6	9
H	C,F	9	15	27
I	E	4	10	16

a) Show the PERT network for the project **(2 pts)**

b) Identify the critical activities**(2 pts)**

c) What is the expected project completion time and its variance? **(2 pts)**

d) What is the probability of completing the project one week before the expected time? **(2 pts)**

Problem 2: (5 pts)

A firm produces four products. There are four operators who are capable of producing any of these four products. The cost per unit of each of the product is given below

Operator	Product			
	P1	P2	P3	P4
O1	10	20	15	20
O2	15	25	20	20
O3	20	25	30	25
O4	20	25	15	20

Required: Determine optimal assignment and the total cost of assignment