

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	Optimization Techniques
Course Code	:	AHS012
Class	:	V Semester
Branch	:	CSE/IT/EEE
Year	:	2019 - 2020
Course Coordinator	:	Mr. R M Noorullah, Associate Professor, Department of CSE

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	Question	Blooms Taxonomy	Course Learning							
5.110.	Question	Level	Outcomes							
	UNIT-I									
	Short Answer Questions									
1	Identify scope of Operations research.	Understand	AHS012.01							
2	Illustrate applications of Operations research.	Understand	AHS012.01							
3	List characteristics of Operations research?	Remember	AHS012.01							
4	Summarize methodology of Operations research.	Understand	AHS012.01							
5	Classify phases of Operations research	Understand	AHS012.01							
6	List Operations research models.	Remember	AHS012.01							
7	Summarize advanced models of Operation research.	Understand	AHS012.01							
8	Identify limitations of Operation research.	Understand	AHS012.01							
9	Classify probabilistic models of Operation research.	Understand	AHS012.01							
10	List simulation models of Operation research.	Remember	AHS012.01							
11	Illustrate analytical models of Operation research.	Understand	AHS012.01							
12	List applications of Operations Research Techniques.	Remember	AHS012.01							
13	Summarize importance of Operation research in the decision making process?	Understand	AHS012.01							
14	List purposes of mathematical model.	Remember	AHS012.02							
15	Describe general representation of LPP.	Understand	AHS012.02							
16	List objective functions of Operations Research in brief.	Understand	AHS012.02							
17	Describe non degenerate basic feasible solution with an example.	Understand	AHS012.02							

18	List non- negativity constraints with an example.	Understand	AHS012.02
19	List constraints of a LPP with an example.	Understand	AHS012.02
20	Classify slack variables with examples.	Remember	AHS012.03
21	Classify surplus variables with examples.	Remember	AHS012.03
22	List artificial variables with an illustration.	Understand	AHS012.03
23	Describe basic feasible solution with an example.	Remember	AHS012.03
24	Describe optimal solution with an illustration.	Remember	AHS012.03
25	Describe feasible region with an example.	Remember	AHS012.03
26	List basic and non basic variables with an example.	Remember	AHS012.03
-	Long Answer Questions		
1	List out terminologies involved in formulating a linear programming problem?	Understand	AHS012.02
2	Define Operations Research. List characteristics of Operations Research.	Understand	AHS012.01
3	Explain methodology involved in Operations Research while solving problems by using different models.	Understand	AHS012.01
4	A farmer has 100 acre farm. He can sell all tomatoes, lettuce, or radishes he can raise. The price he can obtain is Rs 1.00 per kg for tomatoes, Rs 0.75 a head for lettuce and Rs 2.00 per kg for radishes. The average yield per acre is 2000 kg of tomatoes, 3000 heads of lettuce and 1000 kgs of radishes. Fertilizer is available at Rs 0.50 per kg and the amount required per acre is 100 kgs each for tomatoes and lettuce, and 50 kgs for radishes. Labor required for sowing and harvesting per acre is 5 man-days for tomatoes and radishes, and 6 man-days for lettuce. A total of 400 man-days of labor are available at Rs 20.00 per man-day. Formulate this as a Linear-Programming model to maximize the farmer's total profit	Understand	AHS012.02
5	Write step-by-step procedure to solve LPP by BIG-M method with an example.	Understand	AHS012.03
6	Explain the algorithm of simplex method to solve an LPP with an example.	Remember	AHS012.02
7	What are various methods involved in solving problems with artificial variables? Explain steps involved in two phase method	Understand	AHS012.03
8	List various Operations Research models with their applications.	Understand	AHS012.01
9	What are the assumptions to solve LPP using simplex?	Understand	AHS012.02
10	Explain limitations of Operations Research.	Understand	AHS012.01
11	List various definitions involved in Linear Programming Problem.	Remember	AHS012.02
12	Explain step by step procedure to solve Linear Programming Problem by using Graphical Method with an example.	Understand	AHS012.02
13	Solve the following LPP by using graphical method Maximize $Z=3x1+4x2$ Subject to $x1+x2\leq450$ $x1+2x2\leq600$ where $x1, x2 \geq 0$	Understand	AHS012.02
14	Solve the following LPP by using graphical method Maximize Z=2x1+3x2 Subject to $x1+x2\leq30$ $x2\geq3$ $x2\leq12$ $x1-x2\geq0$ $0\leq x1\leq20$ where $x1, x2\geq0$	Understand	AHS012.02
15	Solve the following LPP by using graphical method Minimize Z= - $x1+2x2$ Subject to - $x1+3x2 \le 10$ $x1+x2 \le 6$ $x1-x2 \le 2$ where $x1, x2 \ge 0$	Understand	AHS012.02

16	Solve the following LPP by using Simplex method	Understand	AHS012.02
	Maximize Z=3x1+4x2		
	$x_{1+x}^{2} = x_{1-x}^{2}$		
	x1+2x2≤600		
	where x1, $x2 \ge 0$		
17	Solve the following LPP by using Big M method	Understand	AHS012.03
	Minimize Z=12x1+20x2		
	Subject to $6x1+8x2>100$		
	7x1+12x2>120		
	where $x_1, x_2 \ge 0$		
18	Solve the following LP Problem by two phase simplex method	Understand	AHS012.02
	Maximize $Z=5x1+3x2$		
	Subject to		
	$2x_1+x_2 \ge 1$ $x_1+4x_2 > 6$		
	where $x_1, x_2 \ge 0$		
19	Solve the following LPP by using Simplex method	Understand	AHS012.02
	Maximize $Z=12x1+15x2+14x3$	Chideristand	1110012102
	Subject to		
	$-x1 + x2 \le 0$		
	$-x2+2x3 \le 0$ $x_1+x_2+x_2 \le 100$		
	$x_1 + x_2 + x_3 \ge 100$ where $x_1 + x_2 + x_3 \ge 0$		
20	Solve the following LPP by using Simplex method	Understand	AHS012.02
20	Minimize Z=x1-3x2+3x3	Chidolistand	1110012.02
	Subject to		
	$3x1 - x2 + 2x3 \le 7$		
	$2x_1+4x_2 \ge -12$		
	$-4X1+3X2+8X3 \ge 10$ where x1 x2 x3 > 0		
	where $x_1, x_2, x_3 = 0$		
	Analytical Questions		
1	Analytical Questions Solve the following LP problem graphically	Understand	AHS012.02
1	Analytical Questions Solve the following LP problem graphically Maximize $z = 2r_1 + r_2$	Understand	AHS012.02
1	Analytical Questions Solve the following LP problem graphically Maximize $z = 2x_1 + x_2$ Subject to	Understand	AHS012.02
1	Analytical Questions Solve the following LP problem graphically Maximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$,	Understand	AHS012.02
1	Analytical Questions Solve the following LP problem graphically Maximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$	Understand	AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$	Understand	AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_2 - 2x_2 \le 1$	Understand	AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$	Understand	AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$	Understand	AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$,	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$,	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 9$.	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$	Understand	AHS012.02 AHS012.02
2	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex method	Understand Understand Understand	AHS012.02 AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMore $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMore $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$	Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1 2 3	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to	Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1 2 3	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x1 - 3x2 + 3x3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$	Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $4x_1 + 4x_2 \ge -12$	Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1 2 3	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z = 2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 26$ Solve the following LPP by using Simplex methodMinimize $Z = x_1 - 3x_2 + 3x_3$ $3x_1 + x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1 + x_2 + x_3 \ge 0$	Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1 2 3	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1, x_2, x_3 \ge 0$ Solve the following LPP by using Big-M method	Understand Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02
1 2 3 4	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1, x_2, x_3 \ge 0$ Solve the following LPP by using Big-M methodMaximize $Z=3x_1 - x_2$	Understand Understand Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02 AHS012.03
1 2 3 4	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1, x_2, x_3 \ge 0$ Solve the following LPP by using Big-M methodMaximize $Z=3x_1 - x_2$ Subject to	Understand Understand Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02 AHS012.03
1 2 3 4	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1, x_2, x_3 \ge 0$ Solve the following LPP by using Big-M methodMaximize $Z=3x_1 - x_2$ Subject to $2x_1 + x_2 \le 2$	Understand Understand Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02 AHS012.03
1 2 3 4	Analytical QuestionsSolve the following LP problem graphicallyMaximize $z = 2x_1 + x_2$ Subject to $x_1 + 2x_2 \le 10$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$ where $x_1, x_2 \ge 0$ Solve the following LP problem using Simplex method.Maximize $Z=2x_1 + 5x_2$ $x_1 + 4x_2 \le 24$, $3x_1 + x_2 \le 21$, $x_1 + x_2 \le 9$,where $x_1, x_2 \ge 0$ Solve the following LPP by using Simplex methodMinimize $Z=x_1 - 3x_2 + 3x_3$ Subject to $3x_1 - x_2 + 2x_3 \le 7$ $2x_1 + 4x_2 \ge -12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ where $x_1, x_2, x_3 \ge 0$ Solve the following LPP by using Big-M methodMaximize $Z=3x_1 - x_2$ Subject to $2x_1 + x_2 \le 2$ $x_1 + 3x_2 \ge 3$ $x_2 \le 4$	Understand Understand Understand Understand Understand Understand	AHS012.02 AHS012.02 AHS012.02 AHS012.03

5	Solve the following LPP by using Two Phase simplex method Maximize $Z=5x1 - 4x2+3x3$	Understand	AHS012.03
	Subject to $2x1 \pm x^2 = 6x^2 - 20$		
	$6x1+5x2+10x3 \le 76$		
	8x1 - 3x2+6x3≤50		
	where $x_1, x_2, x_3 \ge 0$		
6	A firm produces three types of biscuits A, B, C it packs them in arrestments of two sizes 1 and 11. The size 1 contains 20 biscuits of	Understand	AHS012.02
	type A, 50 of type B and 10 of type C. the size 11 contains 10 biscuits		
	of the A, 80 of type B and 60 of type C. A buyer intends to buy at		
	least 120 biscuits of type A, 740 of type B and 240 of type C.		
	Determine the least number of packets he should buy. Solve the problem by using Simplex method and also verify result graphically		
7	Solve the following LP problem by two phase method.	Understand	AHS012.03
	Maximize $z = 5x_1 + 8x_2$		
	Subject to		
	$3x_1 + 2x_2 \ge 3$		
	$x_1 + 4x_2 \ge 0$		
	$4 x_1 + x_2 \le 0$		
	$5x_1 + x_2 \ge 0$		
8	where $x_1, x_2 \ge 0$ Solve the following LP problem graphically	Understand	AHS012.02
0	Maximize $z = -x_1 + 2x_2$	Understand	AII5012.02
	S.T. $x_1 - x_2 < -1$.		
	$-0.5x_1 - x_2 \le 2$.		
	$x_1, x_2 \ge 0$		
9	Solve the following LP Problem by graphical method	Understand	AHS012.02
	Maximize Z=5x1+3x2		
	$2x1+x2\leq 1$		
	$x1+4x2 \ge 6$		
	where $x_1, x_2 \ge 0$		
10	Solve the following LP problem by simplex method.	Understand	AHS012.02
	Maximize $z = -x_1 + 2x_2$		
	S.T $x_1 - x_2 \leq -1$,		
	$-0.5x_1 - x_2 \le 2$,		
	$x_1, x_2 \ge 0$		
	UNIT – II Short Answer Questions		
	Short Answer Questions	Blooms	Course
S. No.	Question	Taxonomy	Learning
		Level	Outcomes
1	Summarize mathematical model of a transportation problem.	Understand	AHS012.04
2	List methods to solve transportation problems to get Basic feasible	Remember	AHS012.04
3	Why is LCM is optimal than NWCR in solving transportation		
5	problem?	Understand	AHS012.04
4	Why does Vogel's approximation method provide a good initial	Remember	AHS012.04
~	teasible solution than other methods?	Demonitor	
) 6	List methods to test for optimality in transportation problem.	Remember	AHS012.04
7	List assumptions used in solving transportation problem	Understand	AHS012.04 AHS012.04
8	What is unbalance problem in transportation model.	Understand	AHS012.04
9	Define feasible, basic feasible and optimal solution in transportation	Understand	AHS012.04
	model.		
10	Define constraints of a transportation problem?	Understand	AHS012.04
11	Define an assignment problem.	Remember	AHS012.05
12	List out the applications of assignment problem?	Understand	AHS012.05

13	Give the mathematical representation of an assignment problem.	Understand	AHS012.05
14	What is the difference between assignment problem and travelling salesman problem?	Remember	AHS012.06
15	Discuss the method of solving assignment problems?	Understand	AHS012.05
16	Show that an assignment problem is a special case of a transportation problem?	Understand	AHS012.06
17	Describe an algorithm to solve an assignment problem?	Understand	AHS012.05
18	Draw flowchart for Hungarian method.	Remember	AHS012.05
19	How to solve unbalanced assignment problem.	Understand	AHS012.05
20	List variants in transportation problem.	Remember	AHS012.04
	Long Answer Questions		
1	Explain mathematical model of a transportation problem with an example.	Understand	AHS012.04
2	What are different methods of solving transportation problems to get basic feasible solution? Explain steps involved in VAM method.	Remember	AHS012.04
3	Why is LCM is optimal than NWCR in solving transportation problem? Explain with an example.	Understand	AHS012.04
4	Why does Vogel's approximation method provide a good initial feasible solution than other methods? Explain with an example.	Remember	AHS012.04
5	What are the methods to test for optimality in transportation problem? Explain steps involved in MODI method.	Remember	AHS012.05
6	What is degeneracy in transportation problem? Explain how it will be solved.	Remember	AHS012.05
7	Write about travelling sales man problem? List various types.	Understand	AHS012.06
8	Explain unbalance problem in transportation? Write procedure to solve it.	Understand	AHS012.04
9	Explain steps involved in formulation and solution of Transportation models.	Understand	AHS012.04
10	Explain steps involved in finding initial basic feasible solution by using NWCM method	Understand	AHS012.04
11	What is assignment problem? Explain mathematical representation of an assignment problem	Remember	AHS012.05
12	Explain steps involved in the Hungarian Method for solution of	Understand	AHS012.05
13	List methods to find optimal solution of transportation problem.	Understand	AHS012.04
14	What is the difference between assignment problem and travelling salesman problem? Explain with an example	Remember	AHS012.06
15	Discuss the method of solving unbalanced assignment problem with an	Understand	AHS012.05
16	Show that an assignment problem is a special case of a transportation problem? Explain with an illustration	Understand	AHS012.05
17	How to solve Maximization problems by using assignment problem?	Understand	CAHS012.06
10	Explain with an example.	Doment	AUS012.06
18	Write the unbelonged assignment mehlem?	Linderstard	AIIS012.00
19	write une unbalanced assignment problem ?	Understand	AHS012.05
20	Explain about mathematical representation and assumptions made in transportation problem with an example	Understand	AHS012.04
	Analytical Questions		
1	A Company has three plants at locations A,B and C which supply to	Understand	AHS012.04
	warehouses located at D,E,F,G and H. monthly plant capacities are		
	800,500and900respectively.Monthly warehouse requirements		
	are400,500,400and800unitsrespectively.Unittransportation cost in		
	rupees are given below.		
	D E F G H		
	A 5 8 6 6 3 P 4 7 7 7 5 5		
	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		
	Determine an optimum distribution for the company in order to		
	minimize the total transportation cost by NWCR.		

2	A comp	oany has	factories	at F ₁ , F	2 and	F ₃ tha	at suppl	y products to	Understand	AHS012.04
	ware h	ouses at	W_1 , W_2							
	factorie	s are 2	00,160							
	require	ments ar	e 180,12							
	shippin	g costs ir	n rupees	are as fo	lows.	Find	the opti	imal solution		
	W1 W2 W3 Sup									
		131	16	- 20			ply			
			16	20	12		200	-		
		Г2 F3	14	0	10		100			
		ГЭ Demand	180	120	10	0	90 450			
2				120	15	0	430		Understand	AUS012.05
3	Solve	the follo	wing ass	ignment	probl	em to	minim	ize the total	Understand	AII3012.03
	time of	t the oper	rator	Taba						
		Operato	r 1		2	1	5			
			6	$\frac{2}{2}$, . , .	+ 2	5			
		2	$\frac{0}{2}$	5	2 '	7	7			
		3	7	8 0	5	9	8			
		4	6	2	3	4	5			
		5	9	3	3	9	7			
		6	4	7 4	1	6	8			
4	Difforo	nt machir	las can de	any of th	o fivo	roqui	rad jobs	with different	Understand	AHS012.05
	profits	resulting	from each	ally of u	ent as	showr	in the s	, with university adjusting table		
	Find ou	it maximi	m profit	nossible f	hrough	optir	nal assig	mment.		
		Jobs		Machin	es]	,		
			A B	С	D	Е	_			
		1	30 3	7 40	28	40	-			
		2	40 2	4 27	21	36				
		3	40 3	2 33	30	35				
		4	25 3	8 40	36	36				
		5	29 6	2 41	34	39				
5	A typic	al assign	ment pro	blem, pi	esent	ed in	the clas	ssic manner.	Understand	AHS012.05
	Here th	ere are f	ive mac	hines to	be as	signe	d to fiv	ve jobs. The		
	number	s in the	matrix ir	dicate th	ne cos	t of d	loing ea	ich job with		
	each r	nachine.	Jobs	with co	osts	of N	1 are	disallowed		
	assignm	nents. T	he prob	lem is	to fi	nd t	he mir	imum cost		
	matchin	ig of mac	hines to	jobs						
			J1	J2	J3		J4	_J5		
		M1	M	8	6		12			
		M2	15	12	7		_M	_10		
	-	<u>M3</u>	10	M	5		14			
	-	M4 	12	<u>N</u>	14		10 M	12		
6	 			/					Understand	AHS012.06
0	A sales	nan has	to visit	five citie	s A, I	В, С,	D, E.	The intercity		
	distances	s are tabu	lated belo	w.						
	Г						D	г		
	-		A	<u> </u>	<u> </u>		D 25	_		
	-	A	-	12	24	+	25	_		
		<u>р</u>	10	- 11	10	,	18	-		
		D	10	17	22		-	4		
		E	12	13	23	3	25	1		
	Find the	shortest 1	oute cove	ring all t	ne citie	es.				
7	The ass	ignment	cost of	assigning	o anv	one	operato	r to any one	Understand	AHS012.05
	machin	e is giver	1 in the f	ollowing	table	5110 (Peruto			

					(Operator	S			
				I	II	III	IV			
		Mad	hine	A 10) 5	13	15	4		
			ŀ	B 3	4	18	3	4		
			ŀ	$\frac{D}{D}$	ή ή		1	-		
	Solve the opt	imol acc	ianma		ungorio	n motho	d	_		
Q	The profit aft	tor assign	ning th	n Uy H	ines to i	obs is g	u. ivon ac	follows	Understand	AUS012.05
0	Solve the pro-	blem to	maxim	nize the	profits	003 IS g	iven as	10110W3.	Onderstand	AII5012.05
			12	13	I/	15	16	7		
	M1	5	32	7	6	5	3	-		
	M2	7	6	1	4	2	8			
	M3	6	2	4	3	4	5	1		
	M4	4	6	4	7	3	8			
9	Explain the a	lgorithm	for so	lving tr	ansport	ation pr	oblem	by Vogel's	Understand	AHS012.04
	approximatio	n rule w	ith an e	example	e.					
10	Solve the fol	lowing t	ranspo	rtation j	problem	ı.			Understand	AHS012.04
		А	В	С	D	Suppl	ly			
	I	9	16	15	6	15				
	II	2	1	3	5	25				
	III	6	4	7	3	20				
	Demand	10	15	25	10	60				
										•
				CI.	l	JNII -	- 111			
1	XX/1 / 1°C		6	ð.	hort A	nswer	·Que	stions	TT 1 (1	4110012.07
1	What are diff	erent ty	pes of s	sequenc	ing pro	blems?	11		Understand	AHS012.07
2	List optimali	ty criteri	a consi	idered 1	n seque	ncing pi	oblem	s.	Remember	AHS012.07
3	What are app		s of seq	luencin	g proble	ems?			Understand	AHS012.07
4	research	mnology	y of sec	Juencin	g techn	iques in	operat	IONS	Understand	AHS012.07
5	List assumpti	ions mad	le in so	lving se	equenci	ng prob	lems.		Understand	AHS012.07
6	What are the	conditic	ons to b	e satisf	ied to c	onvert a	'n' joł	os 3	Remember	AHS012.08
	machine prob method clear	olem into ly?	oʻn'jo	bs 2 ma	achine p	roblem	? Expla	in the		
7	Explain abou	t Short I	Process	ing Tin	ne(SPT) rule us	ed in s	olving	Remember	AHS012.08
	sequence pro	blems.								
8	List condition	ns assum	ned in s	solving	n jobs t	hrough	two ma	ichines.	Remember	AHS012.08
9	Processing of method?	r two job	os throu	ign m n	nachine	s will be	e solve	a by which	Understand	AHS012.09
10	Explain abou	t Weigh	ed Sho	rt Proce	essing T	Time(WS	SPT) ri	ile used in	Remember	AHS012.07
	solving seque	ence pro	blems.							
1	Define a mix	ed strate	gy?						Understand	AHS012.10
2	Explain abou	t pure st	rategy.						Understand	AHS012.10
3	Define a two-	person z	zero-su	m gam	e?				Understand	AHS012.11
4	Define n-per	son zero	-sum g	ame?					Understand	AHS012.11
5	What is a rec	tangular	game?)					Understand	AHS012.11
6	Define a strat	tegy?							Remember	AHS012.10
7	What are the	characte	eristics	of a tw	o-perso	n zero-s	um gar	ne?	Understand	AHS012.11
8	State the rule	s for a g	ame th	eory?					Understand	AHS012.10
9	What is sym	netric ga	ames?						Understand	AHS012.11
10	Explain abou	t Domin	ated M	loves in	n game t	heory.			Understand	AHS012.10
				L	ong A	nswer	Ques	stions		

1.	Calculate the	following sequence		Understand	AHS012.08		
	chapsed while	M	& M2				
	I	ob 1	$\frac{\alpha}{2}$ $\frac{1}{3}$	4 5			
	Mach	ine M1 7	10 8	9 7			
	Mach	ine M2 2	1 4	0 5			
	Also find the	total elapsed time	and idle times of	each machine			
2.	Determine the	best sequence for	'5' jobs that will	minimize the		Understand	AHS012.08
	elapsed time	T, if each of the '	5' jobs must go t	hrough machines	А,		
	B and C in th	ne order ABC, The	e processing time	s are.			
	Job		Processingtime				
	1	A	B 5				
	2	10	6	9			
	3	6	2	8			
	4	7	3	6			
)	11	4	>			
3.	A book binde manuscripts printing and below.	r has one printir of 5 different job l binding operation	ng press, one bi ss. The time required for the second seco	nding machine uired for perform t books are sho	and ning own	Understand	AHS012.08
	Job		Processingtime				
	1	8	5	4			
	2	10	6	9			
	3	6	2	8			
	4	7	3	6			
	Decide the optiminimize the to	mum sequence of otal time required					
4.	The following machines. Find complete the jo	table gives machined the sequence of obs.	ne time for the si jobs that minim	ix jobs and the the izes elapsed time	nree e to	Understand	AHS012.08
4.	The following machines. Find complete the jo	table gives machi l the sequence of bbs.	ne time for the s jobs that minim	ix jobs and the the izes elapsed time	nree e to	Understand	AHS012.08
4.	The following machines. Finc complete the jo	table gives machi I the sequence of bbs. Pro Machine A	ne time for the s jobs that minim ocessing Time Machine B	ix jobs and the the izes elapsed time	nree e to	Understand	AHS012.08
4.	The following machines. Find complete the jo	table gives machi I the sequence of bbs. Pro Machine A	ne time for the s jobs that minim ocessing Time Machine B	ix jobs and the the izes elapsed time Machine C	nree e to	Understand	AHS012.08
4.	The following machines. Find complete the jo	table gives machi I the sequence of bbs. Pro Machine A 8 3	ne time for the s jobs that minim ocessing Time Machine B 3 4	ix jobs and the the izes elapsed time Machine C 8 7	e to	Understand	AHS012.08
4.	The following machines. Find complete the jobs	table gives machi 1 the sequence of bs. Prove Machine A 8 3 7	ne time for the s jobs that minim ocessing Time Machine B 3 4 5	Machine C 8 7 6	e to	Understand	AHS012.08
4.	The following machines. Find complete the jobs	table gives machi I the sequence of obs. Pro Machine A 8 3 7 2	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2	Machine C 8 7 6 9	e to	Understand	AHS012.08
4.	The following machines. Find complete the jobs	table gives machi 1 the sequence of bs. Provide A 8 3 7 2 5	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1	Machine C 8 7 6 9 10	e to	Understand	AHS012.08
4.	The following machines. Find complete the jobs	table gives machi I the sequence of obs. Pro Machine A 8 3 7 2 5 1	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6	Machine C 8 7 6 9 10 9	e to	Understand	AHS012.08
4. 5.	The following machines. Find complete the jo Jobs 1 2 3 4 5 6 Suppose we ha machines A & following table	table gives machi table gives machi the sequence of bs. Pro- Machine A 8 3 7 2 5 1 we five jobs, each B in the order A ::	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing time	Machine C 8 7 6 9 10 9 be processed on mes are given in	two the	Understand	AHS012.08 AHS012.08
4. 5.	The following machines. Find complete the joc complete the joc line of the joc	table gives machi d the sequence of obs. Pro Machine A 8 3 7 2 5 1 2 5 5 1 2 5 1 2 5 1 5 5 1 2 5 1 5 5 1 2 5 1 5 5 5 1 2 5 5 5 1 2 5 5 5 5	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing time	Machine C 8 7 6 9 10 9 be processed on mes are given in Machine B	two the	Understand	AHS012.08 AHS012.08
4.	The following machines. Find complete the job complete th	table gives machi table gives machi the sequence of obs. Pro- Machine A 8 3 7 2 5 1 2 5 5 1 2 5 5 1 2 5 5 1 2 5 5 5 1 2 5 5 5 5	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing tim	Machine C 8 7 6 9 10 9 be processed on mes are given in Machine B 3	two the	Understand	AHS012.08 AHS012.08
4. 5.	The following machines. Find complete the joc complete th	table gives machi d the sequence of obs. Provide A 8 3 7 2 5 1 ve five jobs, each B in the order A c: Machine 6 2	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing time	Machine C 8 7 6 9 10 9 be processed on nes are given in Machine B 3 7	two the	Understand	AHS012.08 AHS012.08
4.	The following machines. Find complete the joc complete th	table gives machine table gives machine the sequence of obs. Provide a sequence of obs. Provemation of the sequence of a sequence of a sequenc	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing tim	Machine C 8 7 6 9 10 9 be processed on mes are given in Machine B 3 7 8	two the	Understand	AHS012.08 AHS012.08
5.	The following machines. Find complete the joc complete th	table gives machi d the sequence of obs. Pro Machine A 8 3 7 2 5 1 ve five jobs, each B in the order A c: Machine 6 2 10 4	ne time for the s jobs that minim ocessing Time Machine B 3 4 5 2 1 6 of which has to B. Processing tim	Machine C 8 7 6 9 10 9 be processed on nes are given in Machine B 3 7 8 9	two the	Understand	AHS012.08 AHS012.08
4.	The following machines. Find complete the joc complete th	table gives machi table gives machi the sequence of bs. Provember of the sequence of the sequence of Machine A 8 3 7 2 5 1 twe five jobs, each B in the order A : Machine 6 2 10 4 11	A	Machine C 8 7 6 9 10 9 be processed on mes are given in Machine B 3 7 8 9 5	two the	Understand	AHS012.08 AHS012.08

6	A book binder has one printing press, one binding machine and manuscripts of 7 different book the times required for performing printing and binding operations for different books are shown below.										Understand	AHS012.08			
	Boo	k		1	L	2	3	4		5	e	5	7		
	Prin	ting time (hours)		4	20	90	80	20	0	120	1	15	65		
	Bind	ling time (hours)		2	25	60	75	3	0	90	(1)	35	50		
7	7 A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing times on A and B are given below. Find the optimal sequence, the total minimum elapsed time and idle time for either machine										Understand	AHS012.08			
	Job	Units of each job				ne	Proc Mac	essir hine	ng t B	time					
	1	3	5				8								
	2	4	16				7								
	3	2	6				11								
	4	5	3				5								
	5	2	9				7.5								
	6	3	6	-			14								
8	Ther and H	e are seven jobs, e B in the order AB. I	ach Proc	of w essir	/hich ng tin	has nes	s to g in ho	o thi irs a	rou ire a	igh the as foll	e m .ows	achi s.	nes A	Understand	AHS012.08
	Job	Job 1			1 2 3		4		5		6		7		
	Mac	hine A	3	3 12		15	15 6		1	0	11		9		
	Mac	hine B	8	10)	10		6	1	2	1		3		
	Decie	de a sequence of th	ese j	obs	that	will	mini	mize	e th	e total	l ela	apsec	l time		
9	Find the fo	the sequence that pollowing job on thr	mini mini ee n he fo	miz miz nach	es the ines the ines the	e to in the able	s A and tal time tal oro e.	ne r ler A	equ AB(uired i C. Pro	in p cess	erfor sing	rming times	Understand	AHS012.08
	Job		1		2	3 4 5									
	Mac	hine A	8	3	10		6 7 11		11						
	Mac	hine B	4	5	6		2	3		4					
	Mac	hine C	2	ŀ	9		8	6		5					
10	Ther and H	e are seven jobs, e B in the order AB. I	ach Proc	of w essir	/hich ng tin	has nes	s to g in ho	o thi irs a	rou ire a	igh the as foll	e m ows	achi s.	nes A	Understand	AHS012.08
	Job		1	2		3		4	5		6		7		
	Mac	hine A	6	24	1	30		12	2	0	22		18		
	Mac	hine B	16	20)	20		12	2	4	2		6		
	Decio T. Al	de a sequence of th so find T and idle	lese j time	obs for	that v mach	will ines	mini s A aı	mize nd B	e th	e total	l ela	apsec	l time		
1.	Solv	ve the given matrix			т	_								Understand	AHS012.10
			A		2		-1 0								

2.	Solve by graphical met	thod		Understand	AHS012.12
		B1 B2 A1 [-2 0 A2 3 -1 A3 -3 2 A4 5 -4]			
3.	P Use the principle of d	Player E I II I Player A II 5 6 III 2 1 IV 3 3 Iominance to solve this pr	II IV 4 2 2 4 4 0 5 2 coblem.	Understand	AHS012.12
4.	Consider the followin	Understand	AHS012.11		
5.	Obtain the optimal sigame for two persons	Player-B Player-B A1 A2 A3 A3 A4 A5 A6	ns and the value of the ayoff matrix is as follows B2 -3 5 6 1 2 0	Understand	AHS012.11
6.	Solve by graphical me	ethod $\tilde{B}1^{-}B2$ A1 4 -1 A2 -1 4	B3 0 2	Understand	AHS012.12
7	Consider the modified	pred/prey game with a m	ixed strategy:	Understand	AHS012.11
	Pred/Prey	Active	Passive		
	Active	2,-10	9,-12		
	Passive	3,-5	-1,0		
	Let p=probab. prey is a q=probab. Predator is a	active			
	Find all the mixed strat	tegy equilibrium		TT. J 4 1	A 110010-11
8	$\frac{1}{2}$	game L	R	Understand	AHS012.11
	L	1,-1	-1,1		
	R	-1,1	1,-1		
	What is the maxmin str	rategy for row player?			

9	Consider the following	Game:					Understand	AHS012.11
	1\2	Stay		Leave				
	Stay	-Z, -2		1,0				
	Leave	0,1		0,0				
	In the resulting mixed stating the resulting the state of							
10	Explain difference betw game theory. Explain w	Remember	AHS012.11					
	оп т т ј т п							
1	Strong Book Binder h and the manuscripts o are given in the follow	Understand	AHS012.08					
	Book		Time Ir	Hours				
		Printir	ng		Binding			
	A	5			2			
	В	1			6			
	С	9			7			
	D	3			8			
	E	10			4			
2	There are 5 jobs, each B in the order AB. The	of which has e processing ti	to go throu imes (in ho	igh the ma ours) are g	achines iven as	A and	Understand	AHS012.08
	ERSIJob	: J ₁	J_2	J ₃	J_4	J ₅		
	Machine A	: 2	4	5	7	1		
	Machine B	3	6	1	4	8		
	Determine a sequence time T. Also obtain: i) the minimum ii) ii) the idle ti	of these jobs elapsed time me for each o	that will m e of the mach	inimize th ines	ne total	elapsed		
3	A ready-made garmen 2 stages of production, of these items at the di	ts manufactur , viz. cutting a fferent stages	er has to p and sewing is given b	rocess fiv . The time elow (in h	e items e taken ours):	through for each	Understand	AHS012.08
		Item :	1 2	2 3	4	5		
	Processing time (hours)	Cutting:	5 7	7 3	4	6		
	Trocessing unite (nours)	Sewing :	2 6	5 7	5	9		
	Find an order in wh minimize the total pro- times.	ich these iter cessing time.	ms should Also calcu	be proce late the va	essed s arious i	so as to dle		
4	There are 7 jobs, each B in the order AB. Pro	of which has cessing times	to go throu (in hours)	igh the ma are given	achines as foll	A and ows:	Understand	AHS012.08
	Job : 1	2 3	4 5	6	7			
	Machine A: 3	12 15	6 1	0 11	9			
	Machine B: 8	10 10	6 12	2 1	3			
	Determine a sequence o time. Also calculate the	f these jobs th various idle t	nat will min imes.	nimize the	e total e	lapsed		

5	A machine shop has five machines A, B, C, D and E. Two jobs must be processed through each of these machines. The time (in hours) taken on each of these machines and the necessary sequence of jobs through the shops are given below:							Understand	AHS012.09			
	Job 1 Time	:	A 1 2	B C 4 3	D 6	E 6						
	Job 2 Time	: : : :	C 4 obtain	AD 63 the fe	E 3 otal	B 6 minir	num	elan	sed tin	1e.		
6	Using the graphical method, calculate the minimum time needed to process job 1 and job 2 on five machines A, B, C, D and E, that is, for each machine find the job which should be done first. Also calculate the total time needed to complete both jobs.						Understand	AHS012.09				
	Job 1 Sequence	:	Α	В		С	D	F	E			
	PEOPLETime (in hrs	s) :	1	2		3	5	IE	PE			
	Job 2 Sequence	:	C	A		D	E	ΝĘ	VE			
	1 ime (in mrs	9 .	2	4		2	1				The densition d	AUS012.00
	Use the graphical meth following jobs on the job that should be don completing both jobs.	nod to mach le firs	ines, th t. Also	nize t nat is calc	he ti , for ulate	me ro each the	equire mac total	ed to hino elap	o proce e speci osed tir	ess the fy the ne for	Understand	Анзо12.09
	Job 1 Sequence		8	A	В	1	С		D	E		
	Time (in h	rs)	(1	6	8		4		12	3		
	Job 2 Sequence	-		В	C		A		D	E		
0	Time (in h	rs) :		10	8		6		4	12		A 110010 00
8	A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below.						Understand	AHS012.09				
	Book		1	2	3	4	5		6	7		
	Printing time (hours)		40	180	16	0 40) 24	40	30	130		
	Binding time (hours)		50	120	15	0 60) 13	30	70	100		
	Decide the optimum s minimize the total time	seque: requir	nce of ed to b	proc ring o	cessi out a	ng o ill the	t book book	oks Is.	in ore	ter to		
9	There are seven jobs, e and B in the order AB. I	ach o Proces	f which ssing ti	n has mes i	to g n ho	go thr ours a	ough re as i	the follo	machi ws.	nes A	Understand	AHS012.09
	Job	1	2	3		4	5		6	7		
	Machine A	9	36	45		18	30		33	27		
	Machine B	24	30	30		18	36		3	9		
10	Decide a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.											
10	Find the sequence that minimizes the total time required in performing the following job on three machines in the order ABC. Processing times (in hours) are given in the following table.					Understand	AHS012.09					
	Job 1 2 3 4 5											
	Machine A	24	4 30		18	21	3	3				
	Machine B	15	5 18		6	9	12	2				
	Machine C	12	2 27		24	18	1	5				

1	Consider a	two-person zero	o-sum game matr	ix which	represents payof	f Understand	AHS012.11
	to the playe	er A, see .Find th	ne optimal strateg	gy.			
			Player B				
			I II III	IV V			
			I -2 0 0	5 3			
		Player A	II 4 2 1	3 2			
			$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-2 6			
2	Solve the ge	ma whose never	f motrix is given	2 -0		Understand	AUS012 11
2	Solve the ga	ine whose payor	Player	Delow.		Understand	AII5012.11
		2.21	Flaye	D	-		
		10 ~	~8P1	пш			
		5	0 I -2 I	15 -2			
		Player	A II -5 -	6 -4			
		cater	III -5 3	20 -8	-		
	5	Gr					
3	Solve the ga	me whose payof	ff matrix is given	below:		Understand	AHS012.11
			В				
			5 1	Т			
		P	3 4				
4	Solve by g	raphical method		_		Understand	AHS012.12
			B1 B2	В <u>3</u>	-		
		A1	1 3	12			
		A2	8 6	2_			
5	Consider the following version of the prisoners dilemma game					Understand	AHS012.12
	(Player one'	s payoffs are in	bold):		0		
			Player Two	•			
			Cooperate		Cheat		
	Player One	Cooperate	\$10 \$10		\$0 \$12		
		Cheat	\$12 \$0		\$5 \$5		
	What is each	ch player's dom	inant strategy?				
6	Consider the	e following gar	ne. Two crimin	als are	thinking about	Understand	AHS012.12
	pulling off	a bank robbery	y. The take from	m the b	ank would be		
	and one to d	rive the getawa	v car. Each crimi	nal coul	d instead rob a		
	liquor store.	The take from	robing a liquor s	store is o	only \$1000 but		
	can be done	with one person	acting alone.		-		
	Write down	the payoff matri	x for this game.				
			Player Two	n			
			Bank Job	Liquor	Store		
	Player	Bank Job	20,000 20,000	0	1,000		
	One	Liquor Store	1,000 0	1,000	1,000		
7	Consider the	e following gar	ne. Two crimin	als are	thinking about	Understand	AHS012.12
	901000 pulling 011	a bank robbery	7. The take from	n the t	to rob the bank		
	and one to d	lrive the getawa	y car. Each crimi	nal coul	d instead rob a		
	liquor store.	The take from	robing a liquor s	store is o	only \$1000 but		
	can be done	with one person	acting alone.				
	What are the strategies and equilibrium of this game.					_	
			Player Two			_	
		D 1 - 1	Bank Job	Liquor	Store	_	
	Player	Bank Job	20,000 20,000	0	1,000		
	One	Liquor Store	1,000 0	1,000	1,000	1	

8	Consider the following bargaining problem: \$20 dollars needs to be split between Jack and Jill. Jill gets to make an initial offer. Jack then gets to respond by either accepting Jill's initial offer or offering a counter offer. Finally, Jill can respond by either accepting Jakes offer or making a final offer. If Jake does not accept Jill's final offer both Jack and Jill get nothing. Jack discounts the future at 10% (i.e. future earnings are with 10% less than current earnings while Jill discounts the future at 20%. Calculate the equilibrium of this bargaining problem.					Understand	AHS012.12
9	Consider the game of chicken. Two players drive their cars down the center of the road directly at each other. Each player chooses SWERVE or STAY. Staying wins you the admiration of your peers (a big payoff) only if the other player swerves. Swerving loses face if the other player stays. However, clearly, the worst output is for both players to stay! Specifically, consider the following payouts. (Player one's payoffs are in bold):Player TwoStaySwervePlayerStay-6-62-211					Understand	AHS012.12
10	Consider the center of the SWERVE on big payoff) of other player players to sta (Player one's Player One Does either and Player crash?	Stay Stay Swerve r player have a do	 Two players of at each other, wins you the adrodayer swerves. Sor, clearly, the work consider the followed bid): Player Two Stay -6 -6 -2 2 paninant strategy? 	Inive their c Irive their c Each planiration of particular werving los vorst output wing payou Swerve 2 -2 1 Explain. If at is the ch	ars down the ever chooses your peers (a es face if the t is for both ts. 1 both player A ance that they	Understand	AHS012.12
	1		Short An	swer Que	estions	Blooms	Course
S. No.			Question			Taxonomy Level	Learning Outcomes
1	Define dyn	amic programmir	lg.			Remember	AHS012.14
2	Define stag	ge decision.				Remember	AHS012.15
3	Define state	e and stage.				Remember	AHS012.15
4	Define state	e variable and dec	cision variable.			Remember	AHS012.15
5	what is imi	mediate and optim	nal return.			Remember	AHS012.16
0	State Bellm	an s principle of	optimality.	min ~?		Kemember	AHS012.15
/	State the are	e applications of	io programina -	nnng :		Understand	ADS012.13
0	Write meex	amples of dynam	d in dynamic nee	arommina		Understand	AUS012.10
9	What are the	sive equation use	u in uynamic pro	grainining.	niques?	Dinderstand	AUS012.10
10	What are the requirements of dynamic programming techniques?				inques :	Domombor	AUS012.14
11	What are characteristics of dynamic programming?				Domombar	AUS012.14	
12	What proce	anuamental conce	ed to convert give		5: hlem to	Understand	ΔΗ\$012.13
13	What procedure to be followed to convert given L.P. Problem to Dynamic Programming Problem?					Understand	AUS012.10
14	Write recursive equation of dynamic programming and explain about it					Domombar	AUS012.10
15	Write math	emancal represen	will be useful in	e programm		Remember	ADS012.14
10	advertiseme	ent media?	will be useful in	selection of		Kemember	АПЗ012.15
17	How dynami media?	ic programming v	vill be useful in s	election of a	advertisement	Remember	AHS012.15
18	media? How dynamic programming will be useful in spare part level				Remember	AHS01215	

19	How dynamic prog policy?	gramming will be us	seful in equipment r	eplacement	Remember	AHS012.16
20	How dynamic prog	gramming will be us	seful in inventory co	ontrol?	Remember	AHS012.13
		Lo	ong Answer Qu	estions		
1	Define dynamic p	programming. What	are the characterist	ics of it?	Remember	AHS012.14
2	Use dynamic prop Maximize Z=3x1 Subject to $x1 \le 4$ $x2 \le 6$ $3x1+2x2 x1 \le 18$ where $x_1, x_2 \ge 0$	gramming to solve t +5x2	he following LPP:		Understand	AHS012.15
3	Maximize $z = 5x_1$	$+9x_{2}$			Understand	AHS012.15
	subject to $-x_1+5x_2 \le 3$ $5x_1+3x_2 \le 27$ $x_1, x_2 \ge 0$ Use dynamic progr	ramming to solve th	e above LPP Proble	em.		
4	A vessel is to be weight of <i>w</i> _i and a can take is 5 and Develop the recu valuable cargo lo by using dynamic	loaded with stocks a value of v_i . The m the details of the thr J WJ 1 1 2 3 3 2 rsive equation for th ad without exceeding programming?	a of 3 items. Each i aximum cargo weig ree items are as follo VJ 30 80 65 he above case and the g the maximum car	tem ' <i>i</i> ' has a ght the vessel ows: find the most go weight	Understand	AHS012.16
5	The WORLD H care in the under medical teams a improve their me Therefore, the co allocate to each o of the five teams.	Understand	AHS012.16			
		т	nousands of Addition Person-Years of Life	al		
	Madical		Country			
	Teams	1	2	3		
	0 1 2 3 4 5	0 45 70 90 105 120	0 20 45 75 110 150	0 50 70 80 100 130		
6	Find the shortest	path from city A to	city J by using dyna	amic	Understand	AHS012.17
	programming tech	hnique. B 4 E 4 4 4 C 2 F 4 4 3 C 4 4 3 G G				

7	Solve the following LPP by using Dynamic Programming technique	Understand	AHS012.16
	Maximize $z=2x1+5x2$ subject to		
	2x1+x2 <= 430		
	2x2<=460		
0	where x1,x2>=0	Demonstration	A LIGO 12 14
8	Explain fundamental concepts involved in Dynamic Programming Techniques with an example.	Remember	AH5012.14
9	Explain procedure adopted in analysis of dynamic programming with an illustration.	Remember	AHS012.14
10	Explain about formulation of dynamic programming problem with appropriate equations.	Remember	AHS012.14
11	Explain steps involved in finding shortest path by using dynamic programming techniques.	Understand	AHS012.17
12	Find the shortest path from city A to city O by using dynamic programming technique.	Understand	AHS012.17
	8 00 5		
	TB & CHANS		
	TE SEC AND		
	Mushin Et a creation of the state		
	9 > 6 - 20ret Zone 3		
	Zon 2		
13	Find the shortest path from city 1 to city 12 by using dynamic	Understand	AHS012.17
	programming technique.		
	8 7 1 3 3		
	2 10 7		
	s A Star		
	$(1 \rightarrow 3)$		
	2 10 10		
	376 6		
	A A A		
	stored Star 2		
14	Find the longest path from city A to city O by using dynamic	Understand	AHS012.17
	programming technique.		

	8 3 5		
	THE S CATEL 3		
	10 YES S		
	A 7 IN A KHAT		
	Mushin 8 1 1 6 1 1 1		
	ET SAK 5 SEV		
	Zeni3 Zeni3		
15	Z_{ort}^2 Zort ² Find the longest path from city 1 to city 12 by using dynamic	Understand	AHS012 17
15	programming technique.	Childerstand	7115012.17
	8 1 3		
	5 10 10 5 TO 3 7		
	3 7 c C C C		
	12/2		
1.6	Stratz Stratz	TT 1 . 1	A 110010 1 5
16	Use dynamic programming to solve the above LPP Problem Maximize $z = 8x_1 + 7x_2$	Understand	AHS012.15
	subject to $2x_1+x_2 \leq 8$,		
	$5x_1 + 2x_2 \le 15$, where $x_1, x_2 \ge 0$		
17	Use dynamic programming to solve the above LPP Problem Maximize $z = 4x_1 + 14x_2$	Understand	AHS012.15
	subject to $2x_1 + 7x_2 \leq 21$,		
	$7x_1 + 2x_2 \le 21$, where $x_1, x_2 \ge 0$		
18	Use dynamic programming to solve the above LPP Problem Maximize $z = 3x_1 + 4x_2$	Understand	AHS012.15
	subject to $2x_1 + x_2 \leq 40$		
	$2x_1 + 5x_2 \le 180$, where $x_1 + x_2 \ge 0$		
19	Use dynamic programming to solve the above LPP Problem Maximize $z = x + 0x$	Understand	AHS012.15
	subject to $2\pi + \pi < 25$		
	$2x_1 + x_2 \ge 23,$ $2x_2 \le 11,$ $2x_2 = 10,$		
20	Use dynamic programming to solve the above LPP Problem A_{1}	Understand	AHS012.15
	$\begin{array}{l} \text{Maximize } z = 2x_1 + 4x_2 \\ \text{subject to} \\ 2z = 540 \end{array}$		
	$2x_1 + 3x_2 \le 48,$ $x_1 + 3x_2 \le 42,$		
	$x_1 + x_2 \le 21,$ where $x_1, x_2 \ge 0$		
	Analytical Questions		

1	T	1 1.	11 4	c	6 11 66	Understand	AHS012.17
	In a carg	go-loading	problem, there a	tre four items	of different weight		
	restricted to 17 units. How many units of each item is loaded to						
	maximiz	ze the value	e?		15 100000 10		
	Г	Itom	Weight (w1)	Value]		
		(i)	weight (w1)	(v1)			
	-	1	1	1			
	-	2	3	5			
	-	2	3	7	•		
	-	3	4	1			
		4	6	11			
2	Solve th	e given L.I	P. Model by usin	g dynamic pr	ogramming	Understand	AHS012.16
	techniqu	ie.					
	Maximi	ze Z=8x1+	7x2				
	Subject $2x1+x2$	to < 8					
	$5x1+2x^2$	$\frac{1}{2} \le 15$					
	where x	1,x2>=0					
3	Solve th	e given L.I	P. Model by usin	g dynamic pr	ogramming	Understand	AHS012.16
	techniqu	ie.	4.0				
	Maximi Subject	ze Z=3x1+	4x2				
	2x1+x2	< 40					
	$2x1+5x^{2}$	$2 \le 180$					
	where x	1,x2>=0 ar	nd verify solution	n by using gra	phical method.		
4	Solve th	e following	g LP problem by	dynamic prog	gramming:	Understand	AHS012.16
	Maximi	ze Z = 10x	1 + 8x2				
	subject $2\mathbf{x}1 + \mathbf{x}'$	to $2 < 25$					
	3x1 + 2x	$x_{2} \le 23$					
	$x^2 \le 10$						
	$x_1 \ge 0, z$	$x2 \ge 0$					
	Verify y	our solutio	on by solving it g	raphically.			
5	Solve th	e following	g LP problem by	dynamic prog	gramming:	Understand	AHS012.16
	f(x1 x)	$2e^{2} = (50x1)$	+0.2x21)+(50)	$x^{2} + 0.2x^{2}$	+ 8(x1 - 80)		
	subject t	2) = (30 M)	1 0.2821) 1 (50	XZ + 0.2XZZ	(AI 00)		
	$x1 \ge 80$						
	x1 + x2	= 200					
	$x_1 \ge 0, z$	$x2 \ge 0$					
6	Explain Program	procedure	to solve given L	PP problem b	y using Dynamic	Remember	AHS012.15
7	Solve the	following	I PP by using dy	mamic progra	mming technique	Understand	AH\$012.16
,	Maximiz	z = 3x1+4	-Li by using dy	manie progra	aming comique.	Chucistaliu	1110012.10
	Subject to	0					
	$x_1+x_2 \le 4$	-50 -600					
	x1+2X2≤ where v1	$x_2 > 0$					
8	Solve the	e following	LPP by using dy	vnamic progra	mming technique:	Understand	AHS012.16
-	Minimize	e Z=x1 - 3x	x2+3x3		6 ······		
	Subject t	0					
	3x1 - x2 - 3x1 - x2 - 3x1 - 3x1 - 3x1 - 3x2 - 3x1 - 3x2 -	$+2x3 \leq 7$					
	-4x1+4x2	2 - 12 2 + 8x 3 < 10					
	where x	1, x2, x3 \geq	0				
9	Solve the	e following	LP Problem by	using dynami	c programming	Understand	AHS012.16
	technique	e:	-0				
	Maximiz Subject to	z = 5x1+3	X2				
	$2x1+x2^{<}$	1					
	$x_1+4x_2 \ge$	6					
	where x1	$x_2 \ge 0$					
10	Solve the	e following	LPP by using d	namic progra	amming technique:	Understand	AHS012.16
1	Max1m1z	e Z=5x1 - 4	4X2+3X3				

	Subject to		
	2x1 + x2 - 6x3 = 20		
	$0X1+3X2+10X3 \le 70$ $9x1-2x2+6x2 \le 50$		
	$8x_1 - 5x_2 + 6x_5 \ge 30$ where $x_1 = x_2 = x_3 \ge 0$		
	$\frac{1}{1} \frac{1}{1} \frac{1}$		
	Short Answer Ouestions		
1	Define quadratic approximation?	Understand	AHS012.18
2	Write short notes on nonlinear programming?	Understand	AHS012.18
3	What are Different types of NLP Problems?	Understand	AHS012.18
4	Write short notes on Lengrangian function?	Understand	AHS012.21
5	What is Gradient? Give an example.	Remember	AHS012.20
6	Write short note on Hessian matrix?	Remember	AHS012.20
7	Describe constrained and unconstrained problems?	Remember	AHS012.20
8	What is a quadratic objective function?	Remember	AHS012.18
9	Write short notes on Legrangian Multipliers.	Remember	AHS012.21
10	Write short notes on Generalized Reduced Gradient method.	Remember	AHS012.22
11	Define unconstrained optimization with an example.	Understand	AHS012.18
12	Define linear constrained optimization with an example.	Understand	AHS012.18
13	Explain quadratic programming with an illustration.	Understand	AHS012.18
14	Define convex programming.	Understand	AHS012.21
15	Explain separable programming with an example.	Remember	AHS012.20
16	Define non convex programming.	Remember	AHS012.20
17	Which method is used to solve optimization problems having	Remember	AHS012.20
	continuous objective function and equality or inequality constrains?		
18	What are different cases of quadratic approximation methods for	Remember	AHS012.18
10	constrained problems ?	D 1	4.110.12.21
19	Explain different strategies for quadratic approximation.	Remember	AHS012.21
20	What is constrained variable metric method? Explain with an example	Understand	AHS012.18
1	Long Answer Questions	D 1	4110012.20
1	Explain Various steps in the Direct Successive Quadratic Programming Solution?	Remember	AHS012.20
2	Compare and contrast features of sub problem generated by Direct	Remember	AHS012.21
	function.		
3	Compare the treatment of inequality constraints in the GRG and	Remember	AHS012.21
5	CVM algorithms. How do the methods of estimating multiplier	rteineineer	1110012.21
	values differ?		
4	Solve the problem	Understand	AHS012.20
	Minimize $f(x) = 6x_1 x_2^{-1} + x_2 x_1^{-2}$		
	Subject to $h(x)=x_1x_2-2=0$		
	a(r) - r1 + r2 - 1 > -0		
	$g(x) = x_1 + x_2 = 1 \ge -0$ From the initial face is a continuation of 0 (2, 1) using the direct		
	From the initial leasible estimate $x = (2, 1)$ using the direct successive quadratic programming (OP) strategy?		
5	Explain procedure to find quadratic approximation of the Lagrangian	Remember	AHS012.21
5	function? Give one example?	Kenteniuei	7110012.21
6	Explain the Constrained Variable Metric Method in detail with example?	Remember	AHS012.22
7	Explain different strategies of quadratic approximation methods for	Remember	AHS012.22
	constrained problems with an example.		
8	Solve the problem	Understand	AHS012.20
	Minimize $f(x) = 6x_1x_2^{-1} + x_2x_1^{-2}$		
	Subject to $n(x) = x_1 x_2 - 2 = 0$ $g(x) = x_1 + x_2 - 1 >= 0$		
	From the initial feasible estimate $x^0 = (2, 1)$ using the direct		
	successive quadratic programming (QP) strategy?		

9	Suppose the CVM algorithm were employed with a problem	Understand	AHS012.22
	involving a quadratic objective function and quadratic inequality		
	constraints. How much iteration is likely to be required to solve the		
	problem, assuming exact arithmetic? What assumptions about the problem are likely to be necessary in making this estimate?		
10	Direct Successive Quadratic Programming Solution in solving	Remember	AHS012.20
10	non linear programming techniques?	Remember	71115012.20
11	Differentiate features of sub problem generated by Direct quadratic	Remember	AHS012.21
	approximation and Quadratic approximation of langrangian function.		
12	How equality and inequality constraints in the GRG and CVM	Remember	AHS012.21
	differ?		
13	Solve the problem	Understand	AHS012.20
15	Minimize $f(x) = 4x_1 x_2^{-1} + 2x_2 x^{-2}$	Onderstand	71115012.20
	Subject to $h(x)=x_1x_2-2=0$		
	$g(x) = x_1 + x_2 - 1 > = 0$		
	From the initial feasible estimate $x^0 = (2, 1)$ using the direct		
	successive quadratic programming (QP) strategy?		
14	What are steps involved to find quadratic approximation of the	Remember	AHS012.21
	Legrangian function? Give one example?		
15	How Constrained Variable Metric Method is used in non linear	Remember	AHS012.22
	programming techniques in detail with example?		
16	What are different strategies of quadratic approximation methods for	Remember	AHS012.22
17	Solve the problem	Understand	AHS012 20
17	Minimize $f(x) = 4x_1x_2^{-1} + 2x_2x_1^{-2}$	Onderstand	71115012.20
	Subject to $h(x) = x_1 x_2 - 2 = 0$		
	$g(x) = x_1 + x_2 - 1 \ge 0$ From the initial fractile setimate $x = 0$ (2.1) using the direct		
	From the initial leasible estimate $x^{\circ} = (2, 1)$ using the direct successive quadratic programming (OP) strategy?		
18	If CVM algorithm is employed with a problem involving a quadratic	Understand	AHS012.22
10	objective function and quadratic inequality constraints. How many	Chiefficture	
	iterations are likely to be required to solve the		
	problem, assuming exact arithmetic? What assumptions about the		
10	problem are likely to be necessary in making this estimate?		
19	Solve the problem Minimize $f(x) = 8x_1x_2 - 1 + 6x_2x_3 - 2$		
	Subject to $h(x) = 3x_1x_2 + 6x_2x_1 + 6x_2x_1$		
	$g(x) = x_1 + x_2 - 1 >= 0$		
	From the initial feasible estimate $x^{0} = (2, 1)$ using the direct		
20	successive quadratic programming (QP) strategy?		
20	involving a quadratic objective function and quadratic inequality		
	constraints. How many iterations are likely to be required to solve the		
	problem, assuming exact arithmetic? What assumptions about the		
	problem are likely to be necessary in making this estimate?		
	Analytical Questions	TT 1 1	
1	Given the problem	Understand	AHS012.21
	Minimize $f(x) = 3x^2 - 4x$ Subject to $h(x)=2x + x - 4=0$		
	$g(x) = 37 - x^2 - x^2 - x^2 > -0$		
	1 2		
	the point $x^0 = (-1,6)$, and the multiplier values $(v,u) = ($		
	a) Formulate the Legrangian quadratic programming (QP) sub		
	problem.		
	 b) Show that d=0 is the sub problem solution. c) Show that the point satisfies the second order conditions for 		
	the original problem		

2	Solve the following LP problem using the branch-and-bound method:	Understand	AHS012.21
	Maximize $f = 3x1 + 4x2$		
	subject to		
	$7x1 + 11x2 \le 88, \ 3x1 - x2 \le 12, \ x1 \ge 0, \ x2 \ge 0$		
	xi = integer, i = 1, 2		
3	Solve the problem	Understand	AHS012.21
	Minimize $f(x) = 6x_1x_2^{-1} + x_2x_1^{-2}$		
	Subject to $h(x) = x_1x_2 - 2=0$		
	From the initial feasible estimate $x^0 = (2, 1)$		
	u=0 and $v=0$ by		
4	Solve the problem	Understand	AU\$012.21
4	Minimize $f(r) = 6r_1 r_2 - 1 + r_2 r_2 - 2$	Understand	An5012.21
	$\int (x) - \delta x_1 x_2 + x_2 x_1$		
	Subject to $h(x)=x1x2-2=0$		
	$g(x) = x_1 + x_2 - 1 \ge 0$		
	From the initial feasible estimate $x^0 = (2, 1)$ using the direct		
	successive quadratic programming (QP) strategy and compare		
	with Lagrangian quadratic programming results.		
5	Maximize $f = 4x1 + 2x2 + 3x3 + c4x4$	Understand	CAHS012.21
	subject to		
	$x_1 + x_3 + x_4 \le 24$		
	$3x_1 + x_2 + 2x_3 + 4x_4 \le 48$		
	$2x_1 + 2x_2 + 3x_3 + 2x_4 \le 361 \ge 0, 1 = 1$ to 4		
	Where c4 is a discrete random variable that can take values of 4, 5, 6, or 7 with metablilities of $0.1, 0.2, 0.2$ and 0.4 means timely. Using		
	I agreen guadratic programming (OR mathed find the solution that		
	maximizes the expected value off.)		
6	Given the problem	Understand	AHS012 21
Ū	Minimize $f(x) = 5x^2$ for	Chaciband	1110012.21
	Subject to $h(x)=4x + x - 6=0$		
	$g(\mathbf{r}) = 37 - r^2 - r^2 - r^2 > -0$		
	S(X) 57 X X >=0 1 2		
	the point $x^0 = (-1,6)$, and the multiplier values $(v,u) = ($		
	d) Formulate the Legrangian quadratic programming (OP) sub		
	problem.		
	e) Show that $d=0$ is the sub problem solution.		
	f) Show that the point satisfies the second-order conditions for		
	the original problem		
7	Solve the following LP problem using the branch-and-bound method:	Understand	AHS012.21
	Maximize $f = 3x1 + 4x2$		
	subject to $7x1 + 11x2 < 88 + 2x1 + x2 < 12 + 1 > 0 + 2 > 0$		
	$x_1 + 11x_2 \le \delta\delta$, $5x_1 - x_2 \le 12$, $x_1 \ge 0$, $x_2 \ge 0$		
0	$A_{1} = \operatorname{ming}(1, 1 - 1, 2)$	Understand	AUS012 21
0	Solve the problem Minimize $f(x) = 6x_1 x_2 - 1 + x_2 x_3 - 2$	Understand	ANSU12.21
	Subject to $h(x) = x_1x_2 - 2=0$		
	$g(x) = x_1 + x_2 - 1 \ge 0$ From the initial forcible estimates $y_1 = 0$		
	u=0 and $v=0$ by		
	using the Lagrangian quadratic programming (QP) strategy?		
9	Solve the problem	Understand	AHS012.21
	Minimize $f(x) = 4x_1 x_2^{-1} + 2x_2 x_1^{-2}$		
	Subject to $h(x) = x + x^2 - 2 = 0$		
	Subject to $n(x) = x_1 x_2 - 2 = 0$		
	$g(x) = x_1 + x_2 - 1 \ge 0$		
	From the initial feasible estimate $x^0 = (2, 1)$ using the direct		
	successive quadratic programming (QP) strategy and compare		
	with Lagrangian quadratic programming results.		

10	Maximize $f = 8x1 + 4x2 + 6x3 + 2c4x4$	Understand	CAHS012.21
	subject to		
	$x1 + x3 + x4 \le 24$ 40 1		
	$3x1 + x2 + 2x3 + 4x4 \le 48$		
	$2x1 + 2x2 + 3x3 + 2x4 \le 36i \ge 0, i = 1$ to 4		
	Where c4 is a discrete random variable that can take values of 4, 5, 6,		
	or 7 with probabilities of 0.1, 0.2, 0.3, and 0.4, respectively. Using		
	Legrangian quadratic programming (QP method, find the solution that		
	maximizes the expected value off)		

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