

1. (20 points) Using the big M method to find the optimal solution to the following LP:

$$\min z = -x_1 - x_2$$

$$\text{s.t. } 2x_1 + x_2 = 3$$

$$3x_1 + x_2 \leq 3.5$$

$$-x_1 - x_2 \geq -1$$

$$x_1, x_2 \geq 0$$

2. (20 points) Consider the following LP and its optimal tableau as shown:

$$\max z = 3x_1 + x_2 - x_3$$

$$\text{s.t. } 2x_1 + x_2 + x_3 \leq 8$$

$$4x_1 + x_2 - x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

Z	x_1	x_2	x_3	s_1	s_2	rhs
1	0	0	1	0.5	0.5	9
0	0	1	3	2	-1	6
0	1	0	-1	-0.5	0.5	1

(a) Please formulate its dual.

(b) Find the range of values of b_2 for which the current basis remains optimal. If $b_2=12$, what is the new optimal solution?

3. (20 points) The manager of a job shop must schedule three jobs on four machines. Each job consists of three operations. The processing time (in minutes) for each operation on each machine is given in the following table where x indicates that a job does not have an operation on that machine:

	Machine			
	1	2	3	4
Job 1	23	x	17	18
Job 2	17	20	18	x
Job 3	x	24	x	19

For each job, processing on the machines must be done sequentially; that is, the operation on machine j can begin only after the operation on machine $j-1$ has been completed (or after the operation on machine $j-2$ has been completed if the job has no operation on machine $j-1$). In addition, only one job may be processed on a machine at a given time. The objective is to minimize the time required to complete all three

(背面仍有題目,請繼續作答)

本試題是否可以使用計算機：☒可使用，☐不可使用（請命題老師勾選）

考試日期：0302，節次：3

jobs. Formulate a mixed integer programming model of this problem.

4. (20 points) A company produces cars in plants and ships to warehouses. The number of cars available at each plant, each warehouse needs and their distances are given in the following Tables. Determine an optimal shipping schedule.

Supply and demand table

Plant	Car available	Warehouse	Cars required
Atlanta	5000	Memphis	6000
Boston	6000	Milwaukee	4000
Chicago	4000	N.Y.	4000
L.A.	3000	Denver	2000
		San Francisco	2000

Distance matrix

	Memphis	Milwaukee	N.Y.	Denver	S.F.
Atlanta	10	20	30	40	50
Boston	15	25	35	45	55
Chicago	5	15	40	45	50
L.A.	60	50	40	30	20

5. (20 points) Before a new product can be introduced, the activities in the following Table must be completed. Draw the project diagram and determine a critical path.

Activity	Description	predecessors	Duration
A	Design	--	6
B	Market survey	--	5
C	Purchase raw materials	A	3
D	Receive raw materials	C	2
E	Build prototype	A, D	3
F	Develop ad campaign	B	2
G	Mass production	E	4
H	Deliver to stores	G, F	2