國立臺北科技大學九十九學年度碩士班招生考試

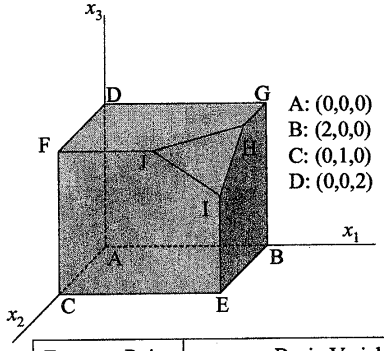
系所組別：4112 工業工程與管理系碩士班甲組

第二節　作業研究　試題（選考）

注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Consider the solution space in the following figure for a linear programming problem:



A: (0,0,0)
B: (2,0,0)
C: (0,1,0)
D: (0,0,2)

Suppose all the constraints are ≤ types and all the variables are nonnegative. Suppose that s_1, s_2, s_3, and s_4 (≥ 0) are the slacks associated with constraints represented by the planes CEIJF, BEIHG, DFJHG, and IJH, respectively.

Please identify the basic and nonbasic variables associated with the feasible extreme points in the table:

Extreme Point	Basic Variables	Nonbasic Variables
B		
F		
H		
I		
J		

(10 points)

2. The following simplex tableau represents some simplex tableau, assuming the original problem is a **maximization** problem and all variables are nonnegative.

	z	x_1	x_2	x_3	x_4	s_1	s_2	s_3	Right Hand Side
z	1	-2	-4	-5	0	3	0	0	120
x_4	0	2	-1	1	1	1/2	0	0	20
s_2	0	-7	0	1	0	-2	1	0	0
s_3	0	3	-5	2	0	1/2	0	1	30

(1) For each nonbasic variables that can improve the value of z, determine the associated leaving variable and the associated change in z. (10 points)

(2) What is the original linear programming formulation for this maximization problem? Please express the problem with only decision variables x_1, x_2, x_3 and x_4. (10 points)

3. Apply phase I of the two phase method to show that the following linear program is infeasible. (20 points)

Maximize $x_1 - 3x_2 + 2x_3$

Subject to $x_1 + 2x_2 + 3x_3 \leq 5$

$2x_1 + 3x_2 + 2x_3 \leq 4$

$2 \leq x_1 \leq 4$, $-\infty \leq x_2 \leq -1$, $3 \leq x_3 \leq 8$

4. Peter is a backpacker and he considers only three items whenever he packs for a trip: food, single lens reflex (SLR) camera kit, and clothes. His backpack has a capacity of 30 liters. Each unit of food takes 10 liters, a SLR camera kit takes about 5 liters, and each set of clothes takes about 2.5 liters. Peter assigns the priority weight 3, 5, and 4 to food, camera kit, and clothes, which means that camera kit is the most valuable of the three items. From the experience, he must take at least one unit of each item and no more than two sets of clothes. How many of each item should Peter take? Please solve this problem by dynamic programming. (25 points)

5. Consider the following inventory problem facing a hospital. There is a need for DTP (diphtheria, tetanus, pertussis) vaccine and the demand D (in doses) over any 3-day period is given by

$P\{D = 0\} = 0.4$, $P\{D = 1\} = 0.3$, $P\{D = 2\} = 0.2$, $P\{D = 3\} = 0.1$.

Note that the expected demand is 1 dose. Suppose that there are 3 days between deliveries. The hospital proposes a policy of receiving 1 dose at each delivery and using the oldest vaccine first. If more vaccine is required than is on hand, an expensive emergency same-day delivery is made. Vaccine is discarded if it is still on the shelf after 21 days.

(1) Formulate the inventory problem as a Markov chain by defining its states and constructing (one-step) transition matrix. (15 points)
(Hint: Assume demand occurs after the delivery.)

(2) Find the steady-state probabilities of the state of the Markov chain. (10 points)