※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

I.1. (20%) Consider the following problem and its resulting final simplex tableau.

$$\begin{array}{lrcrcrcrcl} \text{Maximize} & Z & = & ax_1 & + & bx_2 & + & cx_3 & & \\ \text{subject to} & & & 6x_1 & + & 3x_2 & + & 5x_3 & \le & i \\ & & & 3x_1 & + & 4x_2 & + & 5x_3 & \le & j \\ & & & x_1, & & x_2, & & x_3 & \ge & 0. \end{array}$$

B.V.	x_1	x_2	x_3	x_4	x_5	RHS
Z	0	2	0	$\frac{1}{5}$	$\frac{3}{5}$	d
x_1	1	e	0	g	$-\frac{1}{3}$	$\frac{5}{3}$
x_3	0	f	1	h	$\frac{2}{5}$	3

Identify the value of $a, b, c, d, e, f, g, h, i$ and j.

I.2. (20%) NCKU company makes three products. Each production run of product i invlolves a fixed cost F_i and a per-unit cost c_i. The unit revenue for product i is r_i. These products need two production processes.The time requirement and availabilities for each process are given as follows:

	Product			Hours
Process	1	2	3	available
I	0.25	0.2	0.3	300
II	0.4	0.5	0.2	400

NCKU will upgrade exactly one of two processes. The upgrade will raise the number of availabe hours by 20% for Process I and 10% for Process II. Formulate a mathematical Progamming model to determine which process to upgrade and the production levels to maximize the profit.

I.3. (10%) Consider the following problem:

Maximize $Z = 5x_1 - x_1^2 + 8x_2 - x_2^2 + 10x_3 - x_3^2 + 15x_4 - x_4^2 + 20x_5 - x_5^2$,

subject to

$x_1 + x_3 + x_4 \le 25$,

$x_1 \in \{3, 6, 12\}, x_2 \in \{3, 6\}, x_3 \in \{6, 12\}, x_4 \in \{3, 6, 9, 12\}, x_5 \in \{9, 12, 15, 16\}$, and all these variables must have different values.

Use the techniques of constraint programming (domain reduction, constraint propagation, a search procedure, and enumeration) to identify all the feasible solutions and then to find an optimal solution.

國立成功大學 108 學年度碩士班招生考試試題

系　所：工業與資訊管理學系

考試科目：作業研究

考試日期：0224，節次：2

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II.1 (15%) Data indicates that the number of traffic accidents in NCKU on a rainy day is a Poisson random variable with mean 9, whereas on a dry day it is a Poisson random variable with mean 3. Let X denote the number of traffic accidents tomorrow. The central weather bureau forecasts that it will rain tomorrow with probability 0.6, find

a. The expected value $E(X)$;

b. The probability $P\{X=0\}$;

c. The variance $Var(X)$

II.2 (15%) Wafers arrive at an IC fabrication facility and wait in the buffer area until a total number of k wafers have accumulated. Upon the arrival of the k^{th} wafer, all wafers are instantaneously processed by the machine, and the process repeats. Let x_k, $k = 1, 2, \ldots$, denote the arrivals of wafer in successive periods, assumed to be independent random variable whose distribution is given by $Pr\{x_k = 0\} = \alpha$, and $Pr\{x_k = 1\} = 1-\alpha$, where $0 < \alpha < 1$. Let X_n denote the number of wafers in the system at time n.

a. State assumptions required so that the above production problem can be modeled as a Markov chain;

b. Define state space and show that $\{X_n: n = 0, 1, 2, \ldots\}$ is a Markov Chain;

c. Derive the transition probabilities and the transition probability matrix.

II.3 (20%) Customers arrive at a service station according to a Poisson process of rate λ customer/hour. Let $X(t)$ be the number of customers that have arrived up to time t. Consider a fixed time s for $0 < s < t$, determine

a. The conditional probability $P\{X(t) = n+k \mid X(s) = n\}$;

b. The expected value $E[X(t)\,X(s)]$.