(一) You are going to solve the following Linear Programming problem:

Min f(x) = $4X_1 + X_2$

$3X_1 + X_2 = 3$

$4X_1 + 3X_2 \geq 6$

$X_1 + 2X_2 \leq 4$

$\forall x_i \geq 0$

Table I

	X1	X 2	X 3	R1	R2	X4	
X 1	1	1/3	0	1/3	0	0	1
R2	0	5/3	-1	-4/3	1	0	2
X4	0	3/5	0	-1/3	0	1	3
$Z_j - C_j$	0	(1+5M)/3	-M	(4-7M)/3	0	0	4+2M

(1). Please check whether the Table I is the final table or not? If not, please find out the optimal solution. (4%)

(2). Based on the result in (1), please write down the final table of its dual problem.(7%)

(二)A car rental company is faced with an allocation problem resulting from rental agreements that allow cars to be returned to locations other than those at which they were originally rented. At the present time, there are two locations (sources) with 15 and 13 surplus cars respectively, and four locations (destinations) requiring 9, 6, 7, and "∞" cars, respectively. The minimum requirements for four locations are 6, 6, 7, and 2, respectively. Units transportation costs (in dollars) between the locations are as follows. Please apply the transportation simplex method to find the optimal solution.

	Dest. 1	Dest. 2	Dest. 3	Dest. 4
Source 1	45	17	21	30
Source 2	14	18	19	31

(1) Please apply vogel's method to find the initial solution. (10%)

(2) Please apply the transportation simplex method to find the optimal solution. (7%)

(3) Is it sensitive that we exchange the value of C21 and C13? (4%)

(三)If you are a project manager and are dealing with a project. Please create a Linear Programming model for solving the optimization solution of the Project Management problem. (You have to assume all the related data that the model need) (8%)

(四)Please solve the following Nonlinear Programming problem: (10%)

Max f(x) = $X_1 + X_2 + X_3$ (You can use any approach to solve this problem)

Subject to $X_1^2 + X_2 = 3$

$X_1 + 3X_2 + 2X_3 = 7$ $\forall x_i \geq 0$

(背面仍有題目,請繼續作答)

(五) (20%) Consider the decision analysis problem having the following payoff table:

	State of Nature		
Alternative	S_1	S_2	S_3
A_1	-100	10	100
A_2	-10	30	50
A_3	10	10	60
Prior Probability	0.3	0.3	0.4

(a) Use Bayes' decision rule to determine which alternative should be chosen? What is the resulting expected payoff?

(b) Suppose there is information which will tell with certainty whether the first state of nature S_1 will occur. What is the maximum amount you should pay for this information?

(c) Now suppose there is another information which will tell with certainty which state of nature will occur (perfect information). What is the maximum amount you should pay for this information?

(六) (20%) An airlines reservation system has two computers, one on-line and one backup. The operating computer fails after an exponentially distributed duration having rate μ and is replaced by the standby. There is one repair facility, and repair times are exponentially distributed with rate λ.

(a) Model this system as a Markov Chain.

(b) What is the probability that the reservation system is down?

(七) (10%) Consider $M/M/s$ queuing system, show that

$$L = \sum_{n=0}^{s-1} nP_n + L_q + s(1 - \sum_{n=0}^{s-1} P_n)$$

where L is the expected number of customers in system, L_q is the expected number of customers in queue, and P_n is the probability with n customers in system.