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）

1. (20%) The manager of the assembly plant of an auto manufacturing company is deciding the production schedule for the next month. The plant possesses a capacity of 48000 labor hours during the month and it takes 6 and 10 labor-hours to assemble one 2-door car and one 4-door car, respectively. There are only 20000 doors available from supplier next month. The company forecast the demand for the 2-door cars is limited to 3000 cars. Each 2-door car and 4-door car sold will contribute the company profit $24000 and $36000 respectively.

   (a) To maximize the profit, how many 2-door cars and how many 4-door cars should be assembled.

   (b) The marketing department knows that it can pursue a $1000000 advertising campaign to raise the demand for the 2-door cars next month by 10%. Should the campaign be undertaken?

   (c) The manager knows that he can increase plant's labor capacity 25% next month by using overtime labor. With the new capacity, how many 2-door cars and how many 4-door cars should be assembled.

   (d) What is the maximum amount (lump sum) the manager should be willing to pay for all overtime labor beyond the cost of this labor at regular time rate?

2. (10%) A company with two plants and four customers. The costs of transportation between plants and customers are shown in the table. For each customer, the maximum shipment is 20 units and minimum is 5 units and the maximum shipment from each plant is 30 units. The production costs are $8 and $10 per unit at plant A and B, respectively. Revenues are $14, $17, $20, and $22 for customer 1, 2, 3, and 4, respectively. Set up the transportation tabular for this problem to maximize total profit.

		Customer			
		1	2	3	4
Warehouse	A	10	15	8	13
	B	3	5	7	10

3. (10%) National Cheng-Kung University must purchase 1200 computers from three vendors. Vendor 1 charges $30000 per computer plus a delivery charge of $40000 and will sell at most 900 computers. Vendor 2 charges $20000 per computer plus a delivery charge of $50000 and will sell at most 500 computers. Vendor 3 charges $25000 per computer plus a delivery charge of $60000 and will sell up to 400 computers. Formulate an integer programming problem to minimize the cost of purchasing the needed computers.

4. (10%) For general constrained nonlinear programming problem, state the necessary and sufficient conditions for optimality.

（背面仍有題目，請繼續作答、

5. (12%) The manager of a market can hire either Amy or Linda. Amy, who gives service at an exponential rate of 20 customers per hour, can be hired at a rate of $3 per hour. Linda, who gives service at an exponential rate of 30 customers per hour, can be hired at a rate of $C per hour. The Manager estimates that, on the average, each customer's time is worth $1 per hour and should be accounted for in the model. If customers arrive at a Poisson rate of 10 per hour, then

    (a) What is the average cost per hour if Amy is hired? If Linda is hired?

    (b) Find C if the average cost per hour is the same for Amy and Linda.

6. (13%) You have mineral rights on a piece of land that you believe may have oil underground. There is only a 10% chance that you will strike oil if you drill, but the payoff is $200,000. It costs $10,000 to drill. The alternative is not to drill at all, in which case your profit is zero.

    (a) Draw a decision tree to represent your problem. Should you drill?

    (b) Before you drill you might consult a geologist. She can tell you whether your prospects are "good" or "poor." If there is oil, the conditional probability is 0.95 that she will say prospects are good. If there is no oil, the conditional probability is 0.85 that she will say poor. Draw a decision tree that includes the "Consult Geologist" alternative. Be careful to calculate the appropriate probabilities to include in the decision tree. Finally, Calculate the expected value of information for this geologist. If she Charges $7000, what should you do?

7. (13%) A small barbershop, operated by a single barber, has room for at most two customers. Potential customers arrive at a Poisson rate of three per hour, and the successive service times are independent exponential random variables with mean 1/4 hour. What is

    (a) the average number of customers in the shop?

    (b) the Proportion of potential customers that enter the shop?

    (c) If the barber could work twice as fast, how much more business would he do?

8. (12%) Consider a one-period model where the only two costs are the holding cost give by $h(x-D) = \frac{3}{10}(x-D)$, for $x \geq D$, and the shortage cost, given by $s(D-x) = 2.5(D-x)$, for $D \geq x$, The probability density function for demand is give by

$$f_D(d) = \begin{cases} \dfrac{e^{-d/25}}{25} & \text{for } d \geq 0 \\ 0 & \text{otherwise} \end{cases}.$$

If you order, you must order an integer number of batches of 100 units each, and this quantity is delivered immediately. Let $G(x)$ denote the total expected cost when there are x units available for the period (after ordering).

    (a) Write the expression for G(x).

    (b) What is the optimal ordering policy?