國立臺灣科技大學
九十三學年度博士班考試試題

系所組別：工業管理系甲組
科　　目：作業研究

總分 100 分

1. Suppose that interarrival times to a single-server system are exponential, but when n customers are present, there is a probability $n/(n+1)$ that an arrival will balk and leave the system before entering service. Also assume exponential service times.
   (a) Find the probability distribution of the number of customers present in the steady state (10 分).
   (b) Find the expected number of customers present in the steady state (15 分).

   (Hint: $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$)

2. Consider the equipment replacement problem over a period of n years. At the beginning of each year, it is decided whether to keep the equipment in service for one more year or to replace it with a new one. A piece of new equipment costs c dollars, and its resale value after t years in operation is $s(t) = 2(n - t)$ for $n > t$ and zero otherwise. The annual revenue is a function of the age t and is given by $r(t) = n^2 - t^2$ for $n > t$ and zero otherwise.
   (a) Formulate the problem as a dynamic programming model (10 分).
   (b) Find the optimal replacement policy given c = \$10,000, n = 5, and the equipment is 2 years old (15 分).

3. Consider the following linear programming problem:

$$\text{Minimize } Z = 3x_1 + 4x_2$$

subject to

$$3x_1 + x_2 \geq 2$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

   (a) Use the graphical method to solve the problem. Also, identify all the corner point feasible solutions. (10 分)
   (b) Solve the problem by using the dual simplex method. (15 分)

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4. In the unbalanced transportation problem in the following table, if a unit from a source is not shipped out (to any of the destinations), a storage cost is incurred at the rate of \$5, \$4, and \$3 per unit for sources 1, 2, and 3, respectively. In addition, all the supply at node 2 must be shipped out completely to make room for a new product. Use the Vogel Approximation Method (VAM) to find the initial basic feasible solution. (25 分)

	Destination			
Source	1	2	3	Supply
1	\$1	\$2	\$1	20
2	\$3	\$4	\$5	40
3	\$2	\$3	\$4	30
Demand	30	20	20	