

國立臺灣科技大學 110 學年度碩士班招生試題

系所組別：工業管理系碩士班甲組

科目：作業研究

(總分為 100 分)

1. Consider the following linear program.

$$\begin{aligned} \text{Minimize } Z &= 12x_1 + 6x_2 + 27x_3 \\ \text{Subject to } & 3x_1 + x_2 + 5x_3 \geq 3 \\ & x_1 + x_2 + 3x_3 \geq 2 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

- (1) Solve the problem by the revised simplex method. (10%)
 (2) Construct the dual problem for this primal problem. (10%)
 (3) Solve the dual problem by using the complementary slackness theorem. (10%)
2. Consider the transportation problem having the following parameter table and dual solution (\mathbf{u}, \mathbf{v}) , where $\mathbf{u} = (u_1, u_2, u_3)$ and $\mathbf{v} = (v_1, v_2, v_3, v_4)$.

Unit Shipping Cost	Destination $j =$				Supply	u_i	
	1	2	3	4			
Source $i =$	1	11	10	8	5	200	5
	2	6	8	5	2	100	2
	3	11	5	6	5	150	3
Demand	50	50	200	150			
v_j	4	2	3	0			

- (1) Verify that (\mathbf{u}, \mathbf{v}) is dual feasible. (10%)
 (2) Assuming that (\mathbf{u}, \mathbf{v}) is an optimal dual solution, find an optimal solution of the primal transportation problem using this information. (10%)



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3. A manufacturer has a machine that, when operational at the beginning of a day, has a probability of 0.1 of breaking down sometime during the day. When this happens, the repair is done the next day and completed at the end of that day.
- (a) Formulate the evolution of the status of the machine as a Markov chain by identifying three possible states at the end of each day, and then constructing the (one-step) transition matrix. (10%)
- (b) Find the expected first passage time for all states. Use these results to identify the expected number of full days that the machine will remain operational before the next breakdown after a repair is completed. (10%)
4. Consider an automobile assembly line in which each car undergoes two types of service: painting, then engine installation. Each hour, an average of 22.4 unpainted chassis arrive at the assembly line. It takes an average of 2.4 minutes to paint a car and an average of 3.75 minutes to install an engine. The assembly line has one painter and two engine installers. Assume that interarrival times and service times are exponential.
- (a) On the average, how many painted cars without completely installed engines will be in the facility? (10%)
- (b) On the average, how long will a painted car have to wait before installation of its engine begins? (10%)
5. A wilderness hiker must pack three items: food, first-aid kits, and clothes. The backpack has a capacity of 3 ft^3 . Each unit of food takes 1 ft^3 . A first-aid kit occupies $1/4 \text{ ft}^3$, and each piece of cloth takes about $1/2 \text{ ft}^3$. The hiker assigns the priority weights 3, 4, and 5 to food, first aid, and clothes, respectively, which means that clothes are the most valuable of the three items. From experience, the hiker must take at least one unit of each item and no more than two first-aid kits. How many of each item should the hiker take? (10%)

