

Assignment- LPP

1. A businessman executive has the option to invest money in two plans: Plan A guarantees that each dollar invested will earn \$.70 a year later, plan B guarantees that each dollar invested will earn \$2 after 2 years. In plan A, investments can be made annually, and in plan B, investment are allowed for periods that are multiples of two years only. How should the executive invest \$ 100,000 to maximize the earning at the end of 3 years?
2. The demand for ice cream during the three summer months (June, July, and August) at All-Flavors Parlor is estimated at 500, 600, and 400 20-gallon cartons, respectively. Two wholesalers 1 and 2, supply All-Flavors with its ice cream. Although the flavors from the two suppliers are different, they are interchangeable. The maximum number of cartons either supplier can provide is 400 per month. Also, the prices the two suppliers charge change from one month to the next according to the following schedule:

	Price per cartoon in month		
	June	July	August
Supplier 1	\$100	\$110	\$120
Supplier 2	\$115	\$108	\$125

To take advantage of price fluctuation, All-Flavors can purchase more than is needed for a month and store the surplus to satisfy the demand in a later month. The cost of refrigerating an ice-cream carton is \$5 per month. It is realistic in the present situation to assume that the refrigeration cost is a function of the average number of cartons on hand during the month. Develop an optimum schedule for buying ice cream from the two supplies.

3. All natural coop makes three breakfast cereals a, B, and C from four ingredients: rolled oats, raisins, shredded coconuts and slivered almonds. The daily availabilities of the ingredients are 5 tons, 2 tons 1 ton and 1 ton respectively. The corresponding costs per ton are \$100, \$120, \$110 and \$200. Cereal A is a 50:5:2 mix of oats, raisin and almond. Cereal B is 60:2:3 mix of oats, coconut and almond. Cereal C is a 60:3:4:2 mix of oats, raisin, coconut and almond. The cereal are produced in jumbo 5-lb sizes. All Natural sells A, B and C at \$2, \$2.50 and \$3.00 per box respectively. The minimum daily demand for cereals A, B and C is 500, 600 and 500 boxes. Determine the optimal production mix of the cereals and the associated amount of ingredients.
4. A hospital employs volunteers to staff the reception desk between 8:00 A.M. and 10:00 P.M. Each volunteer works three consecutive hours except for those starting at 8:00 P.M. who work for two hours only. The minimum need for volunteers is approximated by a step function over 2-hour intervals starting at 8:00 A.M. as 4,6,8,6,4,6,8. Because most volunteers are retired individuals, there are willing to offer their services at any hour of the day (8:00 A.M. tp 10:00 P.M.). However, because of the large number of charities competing for their service, the number needed must be kept as low as possible. Determine an optimal schedule for the start time of the volunteers.
5. On most university campuses students are contracted by academic departments to do errands, such as answering the phone and typing. The need for such service fluctuates during work hours (8:00 A.M. to 5:00 P.M.). In the IE department, the minimum number of students needed is 2 between 8:00 A.M. and 10:00 A.M., 3 between 10:01 A.M. and 11:00 A.M., 4 between 11:01 A.M. and 1:00 P.M. and 3 between 1:01P.M. and 5:00 P.M. Each student is allotted 3 consecutive hours (except for those starting at 3:01, who work for 2 hours and those who starts at 4:01, who work for one hour). Because of their flexible schedule, students can usually report to work at any hour during the work day, except that no student

wants to start working at lunch time (12:00 noon). Determine the minimum number of students the IE department should employ and specify the time of the day at which they should report to work.

6. Show how the M-method will indicate that the following problem has no feasible solution

$$\begin{aligned} \text{maximize}(z) &= 2x_1 + 5x_2 \\ \text{subject to} \\ 3x_1 + 2x_2 &\geq 6 \\ 2x_1 + x_2 &\leq 2 \\ x_1, x_2 &\geq 0 \end{aligned}$$

7. Wild west produces two types of cowboy hats. A type 1 hat requires twice as much labor time as a Type 2. If all the available labor time is dedicated to Type 2 alone, the company can produce a total of 400 Type 2 hats a day. The respective market limits for the two types are 150 and 200 hats per day. The revenue is \$8 per Type 1 hat and \$5 per Type 2 hat.

- Use the graphical solution to determine the number of hats of each type that maximizes revenue.
- determine the dual price of the production capacity (in terms of the Type 2 hat) and the range for which it is applicable.
- If the daily demand limit on the type 1 hat is decreased to 120, use the dual price to determine the corresponding effect on the optimal revenue.
- What is the dual price of the market share of the Type 2 hat? By how much can the market share be decreased while yielding the commuted worth per unit?

8. The continuing Education Division at the Ozark Community College offers a total of 30 courses each semester. The courses offered are usually of two types: practical, such as wood working, word processing and car maintenance; and humanistic, such as history, music, and fine arts. To satisfy the demands of the community, at least 10 courses of each type must be offered each semester. The division estimates that the revenues of offering practical and humanistic courses are approximately \$1500 and \$1000 per course, respectively.

- Devise an optimal course offering for the college.
- Show that the dual price of an additional course is \$1500, which is the same as the revenue per practical course. What does this result mean in terms of offering additional courses.
- How many more courses can be offered while guaranteeing that each will contribute \$1500 to the total revenue?
- Determine the change in revenue resulting from increasing the minimum requirement of humanistic by one course.

9. NWACElectronics manufactures four types of simple cables for a defense contractor. Each cable must go through four sequential operations: splicing, soldering, sleeving and inspection. The following table gives the pertinent data of the situation.

Cable	Minutes per unit				Unit revenue (\$)
	Splicing	Soldering	Sleeving	Inspection	
SC320	10.5	20.4	3.2	5.0	9.40
SC325	9.3	24.6	2.5	5.0	10.80
SC340	11.6	17.7	3.6	5.0	8.75
SC370	8.2	26.5	5.5	5.0	7.80
Daily capacity(min.)	4800	9600	4700	4500	

The contractor guarantees a minimum production level of 100 units for each of the four cables.

- Formulate the problem as a LPP model, and determine the optimum production schedule.

- (b) Based on the dual prices, do you recommend making increases in the daily capacities of any of the four operations? Explain.
- (c) Does the minimum production requirements for the four cables represent an advantage or a disadvantage for NWAC Electronics? Provide an explanation based on the dual prices.
- (d) Can the present unit contribution to revenue as specified by the dual price be guaranteed if we increase the capacity of soldering by 10%?

10. JoShop uses lathes and drill presses to produce four types of machine parts, PP1, PP2, PP3 and PP4. The table below summarizes the pertinent data.

Machine	Machine time in minutes per unit of				Capacity (min.)
	PP1	PP2	PP3	PP4	
Lathes	2	5	3	4	5300
Drill Presses	3	4	6	4	5300
Unit revenue (\$)	3	6	5	4	

For the parts that are not produced by the present optimum solution, determine the rate of deterioration in the optimum revenue per unit increase of each of these products.