Assignment 2

Q 1 & Q 2

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1. (Computer Center Staffing) You are the Director of the Computer Center for Gaillard College and responsible for scheduling the staffing of the center. It is open from 8 am until midnight. You have monitored the usage of the center at various times of the day and determined that the following numbers of computer consultants are required.

Time of day	Minimum number of consultants required to be on duty
8 am–noon	4
Noon–4 pm	8
4 am–8 pm	10
8 am–midnight	6

Two types of computer consultants can be hired: full-time and part-time. The full-time consultants work for eight consecutive hours in any of the following shifts: morning (8 am – 4 pm), afternoon (noon – 8 pm), and evening (4 pm – midnight). Full-time consult- ants are paid $14 per hour.

Part-time consultants can be hired to work any of the four shifts listed in the table. Part-time consultants are paid $12 per hour. An additional requirement is that during every time period, at least one full-time consultant must be on duty for every part-time consultant on duty.

A. Determine a minimum-cost staffing plan for the center. In your solution, how many consultants will be paid to work full time and how many will be paid to work part time? What is the minimum cost?

Let,

X_i=Number of full-time workers on shifts

- 8am-4pm
- noon-8pm
- 4pm- 8pm

Y_i=Number of part-time workers on shifts

- 8am-noon
- noon-4pm
- 4pm- 8pm
- 8pm-midnight

Objective function:

Minimum Cost =$[8*14(X_1+X_2+X_3)] + [4*12(Y_1+Y_2+Y_3+Y_4)]$

Constraints:

a. $X_{1+}\ X_2 \geq 4$ → requirement for shift 1
b. $X_{1+}\ X_{2+} + Y_1 + Y_2 \geq 8$ → requirement for shift 2
c. $X_{2+}\ X_{3+}\ Y_{2+}\ Y_3 \geq 10$ → requirement for shift 3
d. $X_3 + Y_4 \geq 6$ → requirement for shift 4

B. After thinking about this problem for a while, you have decided to recognize meal breaks explicitly in the scheduling of full-time consultants. In particular, full-time consultants are entitled to a one-hour lunch break during their eight-hour shift. In addition, employment rules specify that the lunch break can start after three hours of work or after four hours of work, but those are the only alternatives. Part-time consultants do not receive a meal break. Under these conditions, find a minimum-cost staffing plan. What is the minimum cost?

Giving 1-hour break for full time consultants and zero break for part time consultants

Minimum Cost=$[8*14(X_1+X_2+X_3) - 14*(X_1+X_2+X_3)] + [4*12(Y_1+Y_2+Y_3+Y_4)]$

Constraints:

a. $X_{1+}\ X_2 \geq 4$ → requirement for shift 1
b. $X_{1+}\ X_{2+} + Y_1 + Y_2 \geq 8$ → requirement for shift 2
c. $X_{2+}\ X_{3+}\ Y_{2+}\ Y_3 \geq 10$ → requirement for shift 3
d. $X_3 + Y_4 \geq 6$ → requirement for shift 4

2) Back Savers is a company that produces backpacks primarily for students. They are considering offering some combination of two different models—the Collegiate and the Mini. Both are made out of the same rip-resistant nylon fabric. Back Savers has a long-term contract with a supplier of the nylon and receives a 5000 square-foot shipment of the material each week. Each Collegiate requires 3 square feet while each Mini requires 2 square feet. The sales forecasts indicate that at most 1000 Collegiates and 1200 Minis can be sold per week. Each Collegiate requires 45 minutes of labor to produce and generates a unit profit of $32. Each Mini requires 40 minutes of labor and generates a unit profit of $24. Back Savers has 35 laborers that each provides 40 hours of labor per week. Management wishes to know what quantity of each type of backpack to produce per week. Solve this problem graphically.

Solution:

Let,

$X_{1=}$ Number of collegiate backpacks

$X_{2=}$ Number of mini backpacks

Maximize profit:

$Z=32\ X_1 + 24\ X_2$

Subject To:

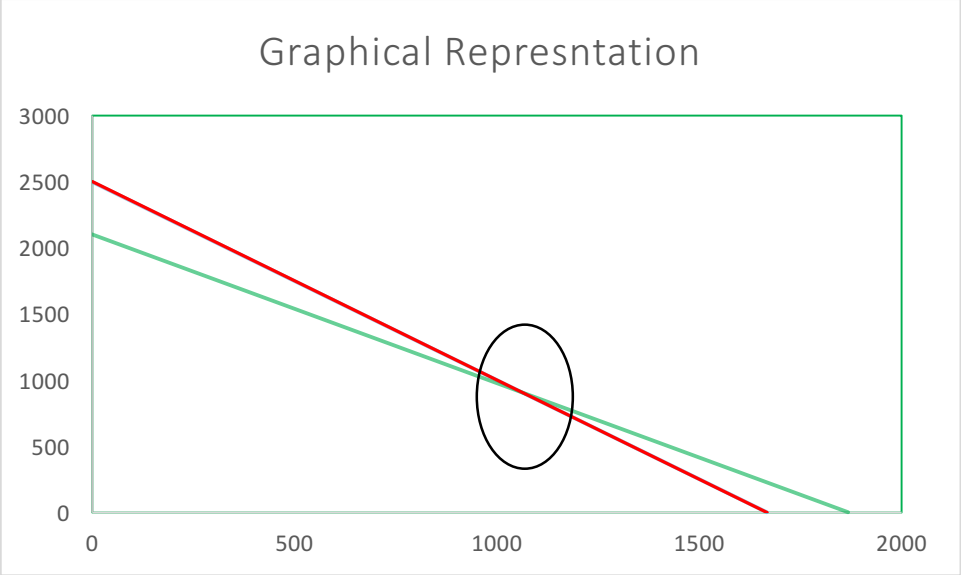
$X_1 \leq 1000$ quantity of backpacks sold by week.

$X_2 \leq 1200$ quantity of backpacks sold by week.

$3\ X_1 + 2\ X_2 \leq 5000$ material used by week

$45\ X_1 + 40\ X_2 \leq 84000$ labor time to produce by week (35 laborers * 40 hours *60 minutes)

$X_1, X_2 \geq 0$


Graphical Represntation
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2000