

Problem 5.15 : RESTAURANT CREW ASSIGNMENT. Burger Boy Restaurant is open from 8:00 A.M. to 10:00 P. M. Daily. In addition to the hours of business, a crew of workers must arrive one hour early to help set up the restaurant for the day's operations, and another crew of workers must stay one hour after 10:00 P. M. To clean up after closing. Burger Boy operates with nine different shifts:

	Shift	Type	Daily Salary
1.	7AM-9AM	Part-time	\$15
2.	7AM-11AM	Part-time	\$25
3.	7AM-3PM	Full-time	\$52
4.	11AM-3PM	Part-time	\$22
5.	11AM-7PM	Full-time	\$54
6.	3PM-7PM	Part-time	\$24
7.	3PM-11PM	Full-time	\$55
8.	7PM-11PM	Part-time	\$23
9.	9PM-11PM	Part-time	\$16

A needs assesment study has been completed, which divided the workday at Burger Boy into eight two-hour blocks. The number of employees needed for each block is as follows:

Time Block	Employees Needed
7AM-9AM	8
9AM-11AM	10
11AM-1PM	22
1PM-3PM	15
3PM-5PM	10
5PM-7PM	20
7PM-9PM	16
9PM-11PM	8

Burger Boy wants at least 40% of all employees at the peak time periods of 11:00 A.M. to 1:00 P. M. and 5:00 P. M. to 7:00 P. M. to be full-time employees. At least two full-time employees must be on duty when the restaurant opens at 7:00 A.M. and when it closes at 11:00 P. M..

- Formulate a model Burger Boy can use to determine how many employees it should hire for each of its nine shifts to minimize its overall daily employee costs.
- Solve for the optimal solution.

Solution:

a. Variables:

- X_1 : 7AM-9AM shift,
 X_2 : 7AM-11AM shift,
 X_3 : 7AM-3PM shift,
 X_4 : 11AM-3PM shift,
 X_5 : 11AM-7PM shift,
 X_6 : 3PM-7PM shift,

X_7 : 3PM-11PM shift,

X_8 : 7PM-11PM shift,

X_9 : 9PM-11PM shift,

b. Model:

MIN: $15 X_1 + 25 X_2 + 52 X_3 + 22 X_4 + 54 X_5 + 24 X_6 + 55 X_7 + 23 X_8 + 16 X_9$

$X_1 + X_2 + X_3 \geq 8$ (7am-9am shift need)

$X_2 + X_3 \geq 10$ (9am-11am shift need)

$X_3 + X_4 + X_5 \geq 22$ (11am-1pm shift need)

$X_3 + X_4 + X_5 \geq 15$ (1pm-3pm shift need)

$X_5 + X_6 + X_7 \geq 10$ (3pm-5pm shift need)

$X_5 + X_6 + X_7 \geq 20$ (5pm-7pm shift need)

$X_7 + X_8 \geq 16$ (7pm-9pm shift need)

$X_7 + X_8 + X_9 \geq 8$ (9pm-11pm shift need)

$-6 X_3 + 4 X_4 - 6 X_5 \leq 0$ (%40 of peak time is full-time)

$-6 X_5 + 4 X_6 - 6 X_7 \leq 0$ (%40 of peak time is full-time)

$X_3 \geq 2$ (at least two employee while openning)

$X_7 \geq 2$ (at least two employee while closing)

Note: You can see the solution of the problem in the excel sheet [g6-s5-p15.xls](#) with using solver.