Assignment Instructions: Module 11 – Integer Programming

Purpose

The purpose of this assignment is to formulate and solve an integer programming problem. In addition, this will help you master the following module outcomes:

- Identify models that satisfy the Integer Programming (IP) model assumptions.
- Examine the solution approach to solving IP problems.
- Formulate an IP Model.
- Solve IP models.

Directions

AP is a shipping service that guarantees overnight delivery of packages in the continental US. The company has various hubs at major cities and airports across the country. Packages are received at hubs, and then shipped to intermediate hubs or to their destination. The manager of the AP hub in Cleveland is concerned about labor costs and is interested in determining the most effective way to schedule workers. The hub operates seven days a week, and the number of packages it handles varies from one day to another. The table below provides an estimate of the number of workers needed each day of the week.

Day	**Workers required**
Sunday	20
Monday	25
Tuesday	22
Wednesday	28
Thursday	25
Friday	22
Saturday	20

Package handlers at AP are guaranteed a five-day work week with two consecutive days off. The base wage for the handlers is $750 per week. Workers working on Saturday or Sunday receive an additional $20 per day. The possible shifts and salaries for package handlers are:

Shift	Days off	Wage
1	Sunday and Monday	770
2	Monday and Tuesday	790
3	Tuesday and Wednesday	790
4	Wednesday and Thursday	790
5	Thursday and Friday	790
6	Friday and Saturday	770
7	Saturday and Sunday	750

Questions

The manager wants to keep the total wage expenses as low as possible while ensuring that there are sufficient number of workers available each day.

1. Formulate the problem.
2. Solve the problem in R markdown.
3. Find the total cost and the number of workers available each day.

Hint: The number of available workers each day can exceed, but cannot be below the required amount

Please submit both Rmd and knitted file of the assignment on Canvas.