INFORMATICS INSTITUTE OF TECHNOLOGY

UNIVERSITY OF WESTMINSTER

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Group-5

Individual Report

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Contents

List of figures

List of tables

1)Problem identification and description

COVID 19 which began in Hubei Province, China in December 2019. Has now been declared a pandemic situation by the World Health Organization. As Sri Lankans we also had to face this pandemic situation. All fields of society must cooperate with the public health authorities. But they can continue their offices according to the health rules and regulations in the country. For an example reduce number of employees coming to the office daily, improve health habits inside the office premises, use mask and sanitizer during the office time, participate to the covid vaccine programs, if employees have fever and other covid symptoms, company must give permission to stay under medical supervision. Trades and companies, in specific, have a main part to play to keep offices safe from covid 19. Most of the companies introduced a work shift schedule for this pandemic situation. from that they can complete their tasks without any issue.

Employee time table scheduling can be used for any company. In this project we discuss about employee's time table schedule for IT Company. But this can apply to other industries as well. We can apply employee scheduling problems (SP) to many situations for an example, including the scheduling of nurses in hospitals, for police officers in the police station, employees in the restaurant, airline services, telephone operators in the companies. According to their company rules and regulations. For an example How employees get their day off. How many maximum number of employees must need per day, how many minimum number of employees need per day? employees working hours and other factors. There are lot of advantages include scheduling to their employees. Because of employee's time table scheduling employees have enough time for family and friends and their leisure activities, employees can achieve a good work life balance. It helps to manage employee attendance matters successfully. Advance satisfaction and productivity

Company must complete the week employee's hours like previous times. **Our objective is assign employees to their work schedules**. One schedule has 5 working days and 2 off days. There are 7 schedules. But one employee must work 5 days per week and company open 7 days. Number of employees coming to the company per week must be same as previous time like before the pandemic situation. Because of pandemic situation all the employees can't come to the office daily. Company decide the maximum number of employees per day and minimum number of employees per day and number of all employees in the company. using that data collection employees have to assign 7 different work shifts. Number of employees must be within the range between maximum number of employees and minimum number of employees.

2.) Literature review

Employees time table scheduling is one of the most popular topic in covid 19 pandemic situation. Because companies and tread industry start to open their companies under covid 19 health rules and regulation. All of the employees can't come to the company. For the employee time table scheduling used assignment problem. There are two types of assignment problems.

1) **Balance assignment problem**
2) Unbalance assignment problem

Company has 20 employees and there are 7 days. Number of employees and number of days are not same. Because of that reason this project is an unbalance assignment problem. For a get solution easily this project converted it to balance assignment problem. For that included 7 different shift. Tt includes 5 work days and 2 days leaves per week. Company have 7 working days. Following table describe the minimum number of employees and maximum number of employees. Using balance assignment problem all employees have to assign 7 different shifts. According to the table minimum number of employees and maximum number of employees are different from day by day according to the work lord of the company.

The problem presented in this paper has been studied in a IT company situated in Colombo sri lanka. An organization which specializes in research development, mainly for the national government. Company takes on multiple projects throughout the course of the entire year. Company open at 9.00 a.m. to 5.00 p.m.

Day	Minimum number of employees	Maximum number of employees
Monday	10	18
Tuesday	10	16
Wednesday	10	18
Thursday	10	15
Friday	10	15
Saturday	10	11
Sunday	10	11
Total number of employees	20	

Table 2.1: Dataset

3.) Problem modelling

The common arrangement of the Linear Programming model basically contains of four components. There are

- Decision Variable
- Objective function
- The constrains
- Non-negativity constrains
- **Decision Variables**

  Decision variables represented by x1, x2, x3, x4, x5, x6, and x7

  X1 =Number of employees work from shift1

  shift no 1 Saturday and Sunday have holiday Monday Tuesday Wednesday Thursday Friday have to work.

  X2 = Number of employees work from shift2

  shift no 2 Thursday and Friday have holiday Monday Tuesday Wednesday Saturday, Sunday have to work.

X3 = Number of employees work from shift3
shift no 3 Tuesday and Wednesday have holiday Monday Thursday Friday Saturday Sunday have to work.
X4 = Number of employees work from shift4
shift no 4 Tuesday and Saturday have holiday Monday Wednesday Thursday Friday Sunday have to work.
X5 = Number of employees work from shift5
shift no 5 Monday and Tuesday have holiday Wednesday, Thursday, Friday, Saturday, Sunday have to work.
X6 = Number of employees work from shift6
shift no 6 Monday and Tuesday have holiday Wednesday, Thursday, Friday, Saturday, Sunday have to work.
X7 = Number of employees work from shift7
shift no 7 Monday and Sunday have holiday Tuesday, Wednesday, Thursday, Friday, Saturday have to work.

- **Objective function**

  - ✓ Objective function of this project is assign all employees to their work schedules.

- **The constrains**
  Constrains of this projects are
- Minimum number of employees per day <= scheduled number of employees per day <= maximum number of employees per day
- Number of employees must be an integer numbers
  (company don't have half day of any other opportunities employees shifts start at 9.amm to 5. 00p.m)
- Number of employees coming to the office per week = 100
  (sum of number of employees in all shifts must be equal to 20. One employee must work 5 days per week (20*5 =100)
- One employee must work 5 working days.
- **Non-negativity constrains**
  X1 >= 0, x2 >=0, x3>=0, x4>= 0, x5 >= 0, x6 >= 0, x7 >=0
  (minimum number of employees in the shift must be zero. number of employees per shift can't be negative number.

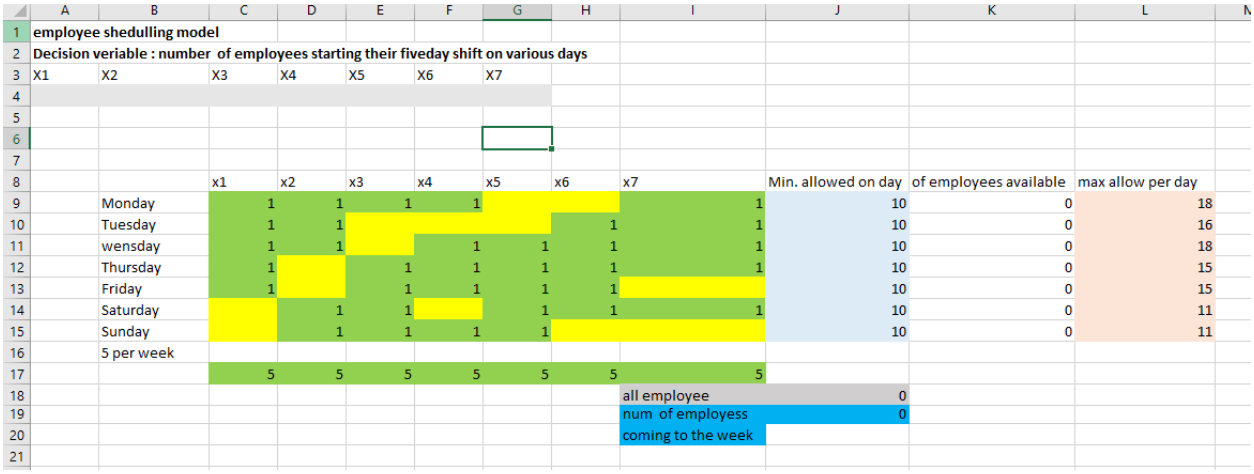
Steps for formulating linear programming model

- Identify and explain the decision variable of the problem
- Explain the objective function
- Add non negativity constrains

- State the constraints

4.) Problem solving

To solve this problem, we use XL sover. following image describe how arrange the xl sheet before the solver run. there are 7 different shifts. Shifts describes x1, x2, x3, x4, x5, x6, and x7. all shifts have 5 working days and 2 days off. We can identify 2 days off it colored by yellow. Data set gave from the company human resources department. Data set mention minimum number of employees each and every day and maximum number of employees each and every day. Schedule number of employees per day we have to find using xlsolver. Sum of scheduled employees per week must be 100 (20*5=100). There are 20 employees work in the company. For better understanding used different clours to the xl sheet .



	A	B	C	D	E	F	G	H	I	J	K	L
1	employee shedulling model											
2	Decision veriable : number of employees starting their fiveday shift on various days											
3	X1	X2	X3	X4	X5	X6	X7					
4												
5												
6												
7												
8			x1	x2	x3	x4	x5	x6	x7	Min. allowed on day	of employees available	max allow per day
9		Monday	1	1	1	1			1	10	0	18
10		Tuesday	1	1				1	1	10	0	16
11		wensday	1	1		1	1	1	1	10	0	18
12		Thursday	1		1	1	1	1	1	10	0	15
13		Friday	1		1	1	1	1		10	0	15
14		Saturday		1	1		1	1	1	10	0	11
15		Sunday		1	1	1	1			10	0	11
16		5 per week										
17			5	5	5	5	5	5	5			
18									all employee	0		
19									num of employess	0		
20									coming to the week			
21												

Figure:1: problem solving image1

Following image describe how fill the xl solver to get a feasible solution Set objective Colum include =SUMPRODUCT (A4:G4). It describes sum of all the employees in the company. after run the xl solver it must be 20. Because according to the company data set there are 20 employees in the company. And for this scheduling problem used minimization. Because this is an employee's scheduling problem. We have to schedule the employees. Maximum number of employees each and every day. xl solver has less than or equal sign. Maximum number of employees or less than employees but can't less than minimum number of employees each and every day. By changing variables cells we included number of employees start their shifts. Subject to the constrains, we added all the constrains related about this project. Regarding about all constrains discussed under problem modelling topic. In here we can see all the constrains according to the mathematical symbols. We select simplex Lp as the solving method. After that we can solve the problem.

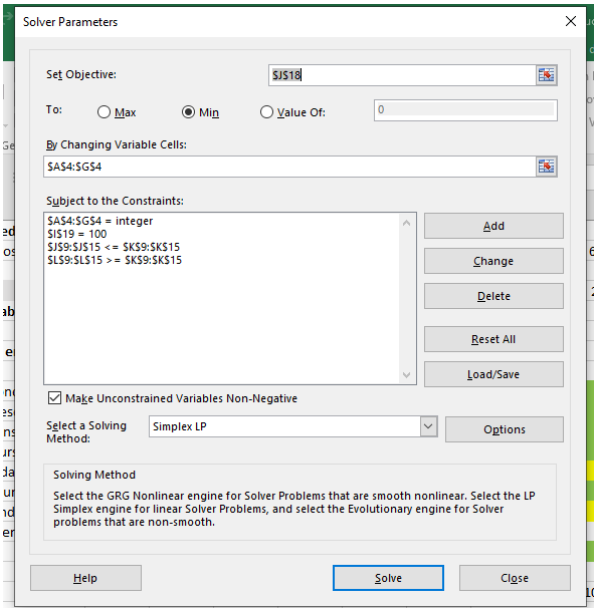


Figure:2: problem solving image 2

Following image shows us the system message before the output show .

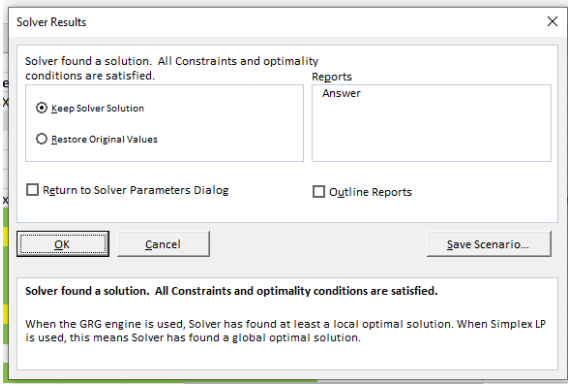
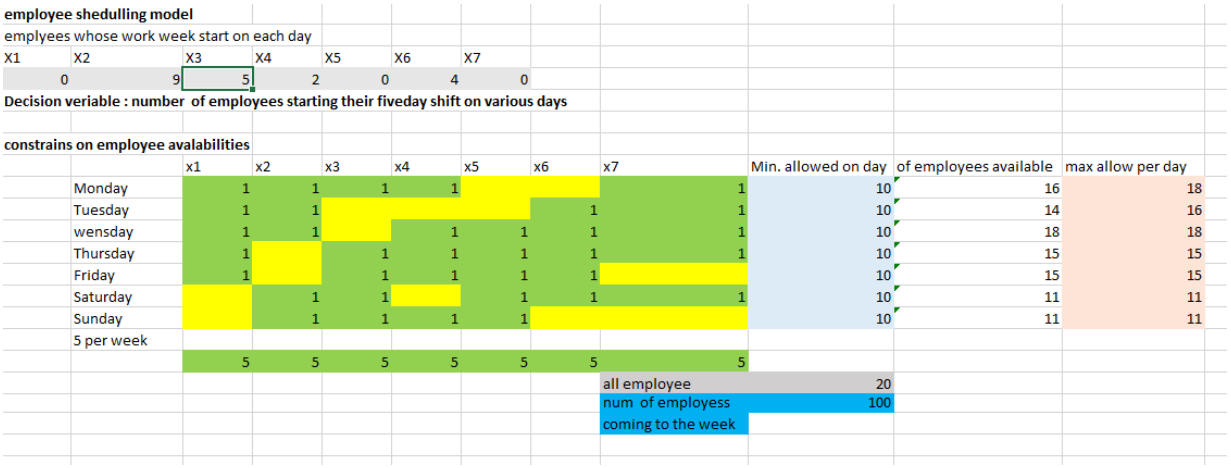


Figure:3: problem solving image 3

Following image show the final out put of the problem . in here we can see all number of emplyees of the company is 20 . It safisfy all the constrains



employee shedulling model

emplyees whose work week start on each day

X1	X2	X3	X4	X5	X6	X7
0	9	5	2	0	4	0

Decision veriable : number of employees starting their fiveday shift on various days

constrains on employee avalabilities

	x1	x2	x3	x4	x5	x6	x7	Min. allowed on day	of employees available	max allow per day
Monday	1	1	1	1			1	10	16	18
Tuesday	1	1				1	1	10	14	16
wensday	1	1		1	1	1	1	10	18	18
Thursday	1		1	1	1	1	1	10	15	15
Friday	1		1	1	1	1		10	15	15
Saturday		1	1		1	1	1	10	11	11
Sunday		1	1	1	1			10	11	11
5 per week										
	5	5	5	5	5	5	5			

all employee	20
num of employess	100
coming to the week	

Figure:4:problem solving image 4

5.) Evaluation of the solution

According to the figure 4 solution satisfy all the constrains . In the solution there are 7 changing varialbles there are x1 ,x2 ,x3 , x4 , x5 , x6 and x7 . according to the solution x1= 0 , x2 =9 , x3 = 5 , x4 = 2 , x5 = 0 , x6 =4 and x7=0 It means there are 0 number of employees belongs to x1 shit . there are 9 number of employees belongs to x2 shift. there are 5 number of employees belongs to x3 shift . there are 2 number of employees belongs to x4 shift . there are 0 number of employees belongs to x5 shift . there are 4 number of employees belongs to x6 shift and there are 0 number of employeees belongs to x7 shift . all the number are integers like mentioned in the constrains . According to the company there are maximum number of employees per day and minum number of employeesper day . Scheduled number of employees must with in the range in the minimum and the maximum numbers. Out put of Xlsolver display the suitable answers .

Day	Minum number of employees	Schedule number of employees	Maximum number of employees
Monday	10	16	18
Tuesday	10	14	16
Wensday	10	18	18
Thursday	10	15	15
Friday	10	15	15
Saturday	10	11	11
Sunday	10	11	11

Image 5.1: answers

According to the company data set there are 20 employees in the company . Therefore sum of

x1+x2+x3+x4+x5+x6+x7 = number of employees in the company

0+9+5+2+0+4+0=20

According to the xl solver solution output is correct .Because output is 20 . When consider about all outputs from the Xlsolver all answers correct and satisfy all the constrains .

6.) Reflection

In here we are going to discuss about how can this solution be used and explanation the usefulness of this solution. Employee scheduling is important to all businesses, big or small. This solution can use company day to day activities without any issue. In this paragraph mention all details about explanation the usefulness of this solution. Because of this solution it helps better manage time and meet deadlines. this company have projects throughout the year. Projects have deadlines. Employees time table scheduling is important for keeping high productivity of employees, work schedules help employees organize their workload better, Employee time table schedule helps their life balance. Life is not only career life family life is also very important from time table scheduling employees can spend their time with family. This also helps keep stress levels lesser. Helps to manage employee attendance issues successfully. Goals become more tangible. The main benefit is because of covid 19situation all employees can't come to the office daily. Because of employee time table schedule we can manage number of employees come to the office daily. It helps to prevent from covid 19 situation.