Problem solving

Workforce planning

1.

There is a small shop with 3 jobs: J1 (manager), J2 (sales person) and J3 (assistant). The shop is open on every weekday from 9:00 to 18:00, and on Saturdays from 8:00 to 12:00. The manager has to perform its duties 8 hours a day on every weekday, independently of the opening hours. The sales staff has to start its work 0.5 hours before the shop opens and finish 1 hour after closing. The assistants have to work only during the opening hours, and they are not working on weekends.

In a year there are 261 weekdays, 52 Saturdays and 52 Sundays (there are no public holidays for the sake of simplicity). All employees are identical. They have 22 regular leave days (allowance) per year and they are expected to be on sick leave for 10 days per year. An employee should work five days in a week and there are 8 working hours in a day.

Calculate the annual workforce demand in man-hours (or person-hours) in every job.

How many employees should be hired in each jobs?

Solution

Demand in J1: 261*8=2088

Employees needed in J1: 2088/[(261-22-10)*8]=1.14

Demand in J2: 261*10.5+52*5.5=3026.5

Employees needed in J2: 3026.5/1832=1.65

Demand in J3: 261*9=2349

Employees needed in J3: 2349/1832=1.28

2.

There is a small factory plant with 12 permanent employees (workers). They are working 8 hours according to their contract. The average attendance rate is 0.9, the average performance is 85%. The maximum number of workers in the plant is 18. The plant is running 1 shift only.

a) Calculate the earliest possible deadline that the plant can accept for an order that needs 600 man-hour to complete.

b) What is the earliest acceptable deadline if the plant hires temporary workers up to the maximum limit, and these newcomers' performance is 60%, their attendance is rate 0.9? The permanent employees' characteristics remain the same.

Solution:

a) 600 / (12 · 8 · 0.9 · 0.85) = 600 / 73.44 = 8.17 = 9 working days

b) 600 / (12 · 8 · 0.9 · 0.85 + 6 · 8 · 0.9 · 0.6) = 600 / 99.36 = 6.04 = 7 working days

3.

There is a small plant with 2 jobs: J1 (first line manager), J2 (worker). The plant's work schedule is as follows:

- from Monday to Friday: first shift: 6:00 to 14:00, second shift: from 14:00 to 22:00
- Saturday: only shift only from 7:00 to 15:00
- Sunday: no working

A manager should be present at the plan 1 hour before the start of the first shift until 1 hour after the last shift. Workers should be there only in their working time (shift). In each shift 3 workers have to work *simultaneously*.

In a year there are 252 weekdays that are working days and 50 Saturdays that are not holidays. All employees are identical (for the sake of simplicity). They have 22 regular leave days (allowance) per year and they are expected to be on sick leave for 11 days per year. An employee should work five days in a week and there are 8 working hours in a day.

a) Calculate the annual workforce demand in person-hours in every (J1 and J2) job.

b) How many employees should be hired in each (J1 and J2) jobs?

Solution:

a)

Labour demand in J1 in man-hours: 252*(16+2) + 50*(8+2) = 5,036 mhrs

Labour demand in J2 in man-hours: [252*(16) + 50*(8)]*3 = 13,296 mhrs

b)

Estimated man-hour supply of one employee in the given year: (252 – 22 – 11)*8 = 1,752 mhrs

Labour demand in J1 in capita: 5,036 / 1,752 = 2.87

Labour demand in J2 in capita: 13,296 / 1,752 = 7.59

4.

There is a small factory plant with 10 permanent employees (workers). They are working 8 hours a day according to their contract. The average attendance rate is 0.9, the average performance is 90%. The maximum number of workers how can simultaneously work in the plant is 15. The plant is running 1 shift only.

a) Calculate the earliest possible deadline that the plant can accept for an order that needs 700 man-hour to complete.

b) What is the earliest acceptable deadline if the employer order 1 hour overwork per day, if the performance rate during the overtime is expected to be only 80%, and 2 of the workers will not perform the overtime work (only the regular 8 hrs per day)? Attendance rate is expected to be 0.75 during overtime. Attendance and performance during the regular work-time will not change.

Solution:

a) 700 / (10 · 8 · 0.9 · 0.9) = 700 / 64.80 = 10.81 = 11 working days

b) 700 / (10 · 8 · 0.9 · 0.9 + 8 · 1 · 0.75 · 0.80) = 700 / 69.6 = 10.06 =11 working days

5.

There is a small factory with 20 permanent employees (workers). They are working 12 hours according to their contract. The average attendance rate is 0.9, the average performance is 95%. The maximum number of workers in the factory is 25. The plant is running 1 shift only (the shift is 12 hours).

a) Calculate the earliest possible deadline that the plant can accept for an order that needs 800 man-hour to complete.

b) What is the earliest acceptable deadline if the plant introduces a new incentive system to increase the average performance level up to 110%?

c) How many temporary workers is necessary to decrease the acceptable deadline to 3 days, if they have an attendance rate of 100% and an average performance of 75%? (the new incentive plan is in use)

Solution:

a) $800 / (20 \cdot 12 \cdot 0.9 \cdot 0.95) = 800 / 205.2 = 3.90 = 4$ working days

b) $800 / (20 \cdot 12 \cdot 0.9 \cdot 1.1) = 800 / 237.6 = 3.37 = 4$ working days

c) $800 / (20 \cdot 12 \cdot 0.9 \cdot 1.1 + X \cdot 12 \cdot 1 \cdot 0.75) \leq 3$
$800 / (237.6 + 9X) \leq 3$
$800/3 \leq 237.6 + 9X$
$3.23 \leq X$

Thus, minimum 4 full time employees should be hired.