# Problem Definition

The problem is to allocate three personnel (P1, P2, P3) to six machines (M1 to M6) with given set of backlog data consists of which machine needs which type of maintenance to be held. The main objective function is to minimize the total cost of skipping maintenance. Each personnel has the ability to perform specific maintenance types, and each machine requires a specific type of maintenance.

# Data

- Machines: M1, M2, M3, M4, M5, M6

- Maintenance Types: MA, MB

- Personnel and maintanence types of each personel can do:

|  |  |  |  |
| --- | --- | --- | --- |
| M. Technician | P1 | P2 | P3 |
| Can Perform Maintenance | MA, MB | MB | MA and MB |

- Cost of skipping maintenance for each maintenance type:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Maintenance type | MA  Cleaning | MB  Lubricating | MC  Change Bearing | MD  Check Vibration | ME | MF |
| Skip Cost – Cost of failing | 200 | 150 | 175 | 50 | 70 | 100 |
| Duration | 2h | 3h | 5h | 2h | 3h | 4h |

Skip Cost:

Probability of failure X Cost of Failure : Skip Cost

State 0:

State 1:

M1 – MA

M1-MA- S1- Done

State 2:

M2-MA

M3-MB

M3-MA

M4-MA-S2 – done

State 3 :

M2-MA -----------------------------------🡪 ‘duration’ -- Skip cost 2h, 200 € ----skip cost / durat: 100

M3- MB--------------------------------------------------------------------- 3h, 150 €

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M1- MB -------------------------------------------------------------------- 3h, 150 €

M2 – MB ------------------------------------------------------------------- 3h,150 €

M3- MA -------------------------------------------------------------------- 2h, 200 €

🡪 p1 = 8h

Op1:

FIFO … 300 €

LIFO … 350 €

- Backlog data for today:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Machine | M1 | M2 | M3 | M4 | M5 | M6 |
| Maintenance to be held | MA | MB | MA | MA | MB | None |

# Objective Function

Minimize the total cost of skipping machine maintenance.

# Constraints

1. Each machine can be assigned to only one person.
2. Each person can be allocated to only one machine at a time.
3. Personnel can only be assigned to machines that they are able to do the maintenance type for.

# Mathematical Formulation

# Sets:

Let:

- M be the set of machines: M = {M1, M2, M3, M4, M5, M6}

- P be the set of personnel: P = {P1, P2, P3}

- T be the set of maintenance types: T = {MA, MB}

Parameters:

Let:

- be the cost of skipping maintenance for machine

# Decision Variables:

Let:

- if machine *i* is assigned to personnel *j,* and 0 otherwise. (where *i* = 1,2…6 and *j* = 1,2,3)

- = 1 if machine *i* is skipped, and 0 otherwise.

# Objective Function:

Minimize the total cost of skipping machine maintenance:

Minimize:

# Constraints:

1. Each machine is assigned to only one person:
2. Each person is allocated to only one machine at a time:
3. Personnel can only be assigned to machines that they are able to do the maintenance type for:
4. Each machine should receive the required maintenance type as indicated by the maintenance backlog data.
5. Binary Constraints.