**(Infosis)**Infosis is a product-based company that manufactures tires for light motor vehicles such as bikes and cars. To expand their business, Infosis is looking to enter supplying tires for heavy automobiles such as Trucks. With deliberate market research, Infosis identified 6 core areas of the market segment that it needs to progress in to keep its edge in competition, with each of these 6 core areas as projects that Infosis wishes to take up and complete successfully. After a careful screening process, Infosis has picked up 8 of its best performing employees to work on these projects. Hourly pay of each of these employees is as shown in the table below. Infosis estimates to complete each of these projects in a set number of hours, as shown in the table below. Also, due to skillset limitations, not all Infosis 8 employees can work on each of these projects. For instance, Employee 1 can work simultaneously on projects 1,2,3 and 5 but not on 4 and 6. Note, also, that more than one auditor can work on a given project, in which case their hours add to the total for the project. Determine how to minimize total billings during the next month. Additionally, Infosis needs to make sure each employee can work up to 160 hours during the next month, during which time six projects must be completed.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Employees\Project | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | $160 | $130 | $130 |  | $160 |  |
| 2 | $170 |  | $170 | $160 |  | $180 |
| 3 | $130 | $170 | $160 |  | $160 | $160 |
| 4 |  | $190 | $130 | $190 |  | $190 |
| 5 |  | $140 |  | $130 | $130 | $170 |
| 6 | $140 | $160 | $170 |  | $150 |  |
| 7 |  | $180 | $140 | $130 | $140 | $140 |
| 8 | $150 | $170 | $190 | $160 | $120 | $140 |
|  |  |  |  |  |  |  |
| Project | 1 | 2 | 3 | 4 | 5 | 6 |
| Hours required | 180 | 200 | 200 | 170 | 150 | 190 |

**Discussion:**

The objective of our problem is to increase the profit for Infosis by optimizing utilization of employees for the project. Having said that we must make sure that the employee does not work more than 160 hours. Also, the employees are assigned to the projects in such as way that the projects are complete. Total billed amount is sum-product of the hourly billing amount and hours worked by each employee to each project. So, we can go for Number of hours an employee worked on each project as our decision variable.

**Mathematical Model:**

**Parameters:**

$$i \left\{1,2,…8\right\} (i:Index for employees\}$$

$$j ϵ \left\{1,2,…6\right\} (j:Index for project\}$$

$A\_{k} : Hourly billing amount of employee i working on project j, for (i,j) belong to k, where k is the set of all valid (i,j) pairs$

$$D\_{j} : Hours required to complete project j$$

$$M : Total Hours an employee can work per month. M = 160$$

**Decision variable:**

$X\_{k} : Number of hours employee i worked on project j, for (i,j) belong to k, where k is the set of all valid (i,j) pairs $

**Objective:**

$Maximize the total Billing cost to the company:\sum\_{k \in valid (i,j)}^{ }(X\_{k}.A\_{k}$**)**

**Constraint:**

$$\sum\_{j=1}^{6}X\_{ij} \leq M; for i\in \{1,2,..8\} (1. Employee Maximum working hours)$$

$$\sum\_{i=1}^{8}X\_{ij} \geq D\_{j}; for j\in \{1,2,..6\} (2. Hours required to complete the project) $$

$$X\_{k} \geq 0; for k\in valid (i,j) pairs (3. Non-negativity constraint)$$

**Excel Model:** Model is attached below. Snapshot of the model is as follows:

