A farm company in Texas has three farms that produce grain at capacities of 93, 88 and 95 thousand barrels of grain per day respectively. The company also owns five storage buildings along the Gulf Coast, all of which have been operating at stable demand levels. Three pump stations have been built to move the grain from the farms to the storage buildings. Grain can flow from any one of the farms to any of the pump stations and from any one of the pump stations to any of the storage buildings. The company is looking to develop a minimum cost schedule for their systems. The storage buildings requirements are as given the Table 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Refinery | 1 | 2 | 3 | 4 | 5 |
| Requirement (thousand barrels/day) | 30 | 57 | 48 | 91 | 48 |

The company’s cost accounting system recognizes charges by the segment of pipeline

that is used. These daily costs are given in Tables 2 in thousands of dollars per thousand barrels.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 2 |  |  | *To* |  |  |
|  |  | Pump 1 | Pump 2 | Pump 3 | Available |
|  | Farm 1 | 1.52 | 1.60 | 1.40 | 93 |
| *From* | Farm 2 | 1.70 | 1.63 | 1.55 | 88 |
|  | Farm 3 | 1.45 | 1.57 | 1.30 | 95 |
|  |  |  |  |  |  |
|  |  | From | | |  |
|  | To | Pump 1 | Pump 2 | Pump 3 | Required |
|  | Storage 1 | 5.15 | 5.12 | 5.32 | 30 |
|  | Storage 2 | 5.69 | 5.47 | 6.16 | 57 |
|  | Storage 3 | 6.13 | 6.05 | 6.25 | 48 |
|  | Storage 4 | 5.63 | 6.12 | 6.17 | 91 |
|  | Storage 5 | 5.80 | 5.71 | 5.87 | 48 |

Questions:

1. Formulate a linear model to minimize the company’s cost and put it in standard

format. Clearly define your decisions variables, objective function and constraints

1. Implement your formulation in Excel and use Solver to find the optimal solution.

Provide answers for the minimum cost of providing oil to the refineries and the optimal amounts shipped across each segment  
(provide a snapshot of your Excel solution in an organized way)

1. Which farms are used to the full capacity in the optimal solution
2. If pump 2 must be taken down for maintenance, what would be the new optimal

solution and how much does this decision cost the company? Show how you would model this condition and provide a snapshot of your Excel solution in an organized way.