**MCP 261 IE Lab 1, Groups 1 and 2: April 11, 2019**

**Exercise 10**

1. **(4 marks)** For the following directed network with a single source A, we have the following edges in the network with the respective edge weights. The shortest path between the source A to any other node is the path having the minimum total weight. Find the minimum total weights of the shortest paths from A to all other nodes using dynamic programming (Bellman-Ford algorithm). Use Matlab to write the code for it and generate the results.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EDGE | WEIGHT | EDGE | WEIGHT | EDGE | WEIGHT | EDGE | WEIGHT |
| A to B | 2 | C to H | -2 | G to I | -2 | J to M | -1 |
| A to C | 3 | D to G | 4 | G to J | 2 | K to L | 5 |
| A to D | 3 | D to H | -3 | G to K | 1 | K to M | -1 |
| A to E | 4 | E to F | -4 | H to J | 1 | L to N | -2 |
| B to F | -1 | E to G | -1 | H to K | -2 | M to N | 2 |
| B to G | 2 | E to H | 2 | I to L | -3 |  |  |
| B to H | 1 | F to I | 3 | I to M | 2 |  |  |
| C to F | 1 | F to J | -1 | J to L | 3 |  |  |

1. **(3 marks)** Use Excel solver to formulate the following problem as a linear programming problem such that the total cost of transporting goods from the factories to the warehouses is minimized. The costs are given along with the total capacities of the factories and the total demands of the warehouses.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **W/H 1** | **W/H 2** | **W/H 3** | **W/H 4** | **W/H 5** | **W/H 6** | **W/H 7** | **Capacities** |
| **Factory 1** | **400** | **320** | **220** | **340** | **440** | **360** | **380** | **40** |
| **Factory 2** | **500** | **440** | **460** | **520** | **560** | **460** | **450** | **70** |
| **Factory 3** | **300** | **240** | **280** | **260** | **200** | **250** | **270** | **50** |
| **Factory 4** | **200** | **210** | **180** | **170** | **190** | **210** | **150** | **60** |
| **Factory 5** | **450** | **400** | **380** | **460** | **420** | **410** | **500** | **80** |
| **Factory 6** | **600** | **320** | **400** | **500** | **340** | **400** | **360** | **70** |
| **Factory 7** | **280** | **300** | **320** | **240** | **300** | **320** | **390** | **90** |
| **Demands** | **45** | **65** | **40** | **50** | **25** | **35** | **100** |  |

1. **(3 marks)** There are two milling machines in a factory which can produce three grades of spur gears- Gear A, Gear B and Gear C. There are three production strategies which can be adopted- strategy 1- produce at most 30 units of gear A, at most 40 units of gear B and at most 36 units of gear C; strategy 2- produce at most 35 units of gear A, at most 32 units of gear B and at most 40 units of gear C; strategy 3- produce at most 40 units of gear A, at most 34 units of gear B and at most 34 units of gear C. Each production strategy can be adopted on one machine and hence in a day only two strategies can be adopted. Due to a superstition prevalent in the factory, the strategy adopted on machine 1 is always the strategy number coming first (for example if strategy 2 and 3 are selected, then strategy 2 goes to machine 1). The production limit of each machine is 107 units of gears. The profit on each unit of Gear A, Gear B and Gear C is Rs 180, Rs 185 and Rs 182 respectively. Find which two strategies will you adopt to maximize the daily profit by formulating it as an integer linear programming problem in Excel Solver.