# Dated: 24th May 2022

Mohammad Ali Jinnah University

**Department of Computer Science CS2420: Operations Research Semester Spring 2022**

# Due Date: 31st May 2022 (In class) Home Work # 8

**Total Points 50**

**Home Work # 8**

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**Teacher:** Dr. Abdul Qadar Kara

**Section:** BM

# ASSIGNMENT PROBLEM (20 points, 10 points each)

Solve the following assignment problem using the Hungarian method. Show all the steps. Compute z for the solution.

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| --- | --- | --- | --- | --- |
| 7 | 8 | 6 | 7 | 7 |
| 6 | 5 | 2 | 7 | 5 |
| 6 | 3 | 2 | 7 | 5 |
| 9 | 8 | 2 | 10 | 3 |
| 8 | 4 | 12 | 3 | 5 |

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| --- | --- | --- | --- | --- |
| 11 | 10 | 18 | 5 | 9 |
| 14 | 13 | 12 | 19 | 6 |
| 5 | 3 | 4 | 2 | 4 |
| 15 | 18 | 17 | 9 | 12 |
| 10 | 11 | 19 | 6 | 14 |

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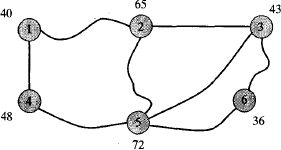
# INTEGER LINEAR PROBLEM FORMULATION (10 points each)

1. The River City redevelopment authority wants to add a minimum of one thousand new parking spaces in downtown area. The following table shows the estimated cost (in millions of dollars) of the four proposed projects and a number of spaces each would yield (in hundreds). The goal is to minimize cost.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Project | | | |
| 1 | 2 | 3 | 4 |
| Cost | 16 | 9 | 11 | 13 |
| Spaces | 8 | 3 | 6 | 6 |

Formulate it as an ILP problem.

1. The following map shows the 8 intersections at which automatic traffic monitoring devices might be installed. A station at any particular node can monitor all the road links meeting that intersection. Numbers next to node reflect the monthly cost (in thousands of dollars) of operating a station at that location.



Formulate the problem as an ILP that minimizes monthly cost.

1. For the above problem, add the following constraints.
   1. If there is a device installed at node 1, then there should be a device installed at node 5.
   2. Either there is a device installed at node 5 or at node 3 but not both.
   3. If there is a device installed at node 4, then there should be a device installed at node 6 and vice versa.