

### Homework #3

Solve the following problems.

1. In Maximum Weight Matching problem, we are given a weighted graph and we are looking for a matching where the selected edges have maximum total weight. For the graph in Figure 1, the weight of each edge  $e_i = i$ . Find a solution to this problem.
2. Describe a greedy approach to solving Maximum Weight Matching, and apply it to the graph in Figure 1. Describe an instance of the problem that your greedy algorithm does not solve correctly, and explain why the algorithm fails.
3. Explain why a greedy approach to solving the Knapsack problem based on the ratio of the value to the cost of each item makes sense. Describe an instance of the problem that this approach does not solve correctly, and explain why the algorithm fails.
4. Describe an instance of the Activity Assignment problem that is not correctly solved by the following algorithm: Order the activities by increasing start times, consider the activities one by one in order, add an activity if it does not conflict with any previously added activity.
5. For the Maximum Matching problem applied to the bipartite graphs in Figures 2 and 3:
  - (a) given the matching  $A$  in each case, give augmenting paths containing three and five edges, if they exist,
  - (b) given the matching  $A$  in each case, show the vertices visited in the breadth-first search for an augmenting path,
  - (c) give the corresponding improved matching,