Name: _____

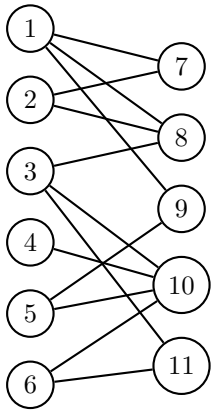
1. (1 pt.)

   - **Read all material carefully.**
   - *If in doubt whether something is allowed, ask, don't assume.*
   - You may refer to your books, papers, and notes during this test.
   - E-books may be used *subject to the restrictions* noted in class.
   - No computer or network access of any kind is allowed (or needed).
   - Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
   - Use class and textbook conventions for notation, algorithmic options, etc.

   Write your name in the space provided above.

2. $(9 + 25 + 5 = 39$ pts.)

   (a) Using the reduction discussed in class, map the following instance of the Maximum Bipartite Matching problem to an instance of the Maximum Flow problem. Clearly indicate all inputs to the maximum flow problem.



(b) Trace the execution of the EDMUNDS-KARP algorithm on the max-flow instance of Question 2a. For the first two flow-augmentations, depict the residual network and new (augmented) flow following the conventions of Figure 26.6 (p. 726) of the textbook. (You need not show the details for the remaining augmentations.) You may abbreviate provided the result is unambiguous. Clearly indicate the final (maximum) flow.

[additional space for answering the earlier question]

(c) Map the solution of Question 2b to a solution of the initial maximum bipartite matching problem of Question 2a.

3. $(10 + 15 + 5 = 30$ pts.)

(a) Using the reduction discussed in class, reduce the following instance of the SUBSET-SUM problem to an instance of the KNAPSACK decision problem. Clearly indicate the inputs and the decision question for the knapsack problem.

$$\begin{aligned} S &= \{1, 3, 7, 9, 20, 35, 42, 63, 84, 103, 171\} \\ t &= 100 \end{aligned}$$

(b) Provide a solution to the KNAPSACK decision instance of Question 3a (using an arbitrary method of your choice). You do *not* need to state your method or show your work. *However*, you should provide a brief justification of the correctness of your solution.

(c) Based on the reduction of Question 3a, map the KNAPSACK solution of Question 3b to a solution for the SUBSET-SUM instance of Question 3a.