CS 401, Homework 1

State all necessary assumptions clearly.
Show all the steps and give complete answers.
Please write legibly or type and print your answers.

Submit via Gradescope. Remember to associate page numbers of your solution PDF file to question numbers.

1. There are $2n$ men. In how many ways can they be paired up?
2. Chapter 1, Exercise 1
3. Chapter 1, Exercise 3
4. Chapter 1, Exercise 4
5. Read and understand Footnote 2 on pages 16-17. Then, show that:
   (a) The graph in Fig 1.3(a) cannot arise as the conflict graph in an instance of Interval Scheduling.
   (b) The graph in Fig 1.3(b) cannot arise as the conflict graph in an instance of Bipartite Matching.
6. Chapter 2, Exercise 3
7. Arrange the following functions in ascending order of growth rate.

   $f_1(n) = 2^{\sqrt{\log n}}$, $f_2(n) = n(\log n)^3$, $f_3(n) = 2^n$ $f_4(n) = n^{5/3}$, $f_5(n) = n^{\log n}$, $f_6(n) = 2^{2^n}$, $f_7(n) = 2^{n^2}$

8. You are given an array A of n distinct integers, and an integer T.
   (a) Give an algorithm to find two numbers from A that add up to exactly T (if two such numbers exist). Your algorithm should have as low time complexity as possible. Can you solve in $O(n \log n)$?
   (b) Prove that your algorithm is correct.