

## Problem Set 5

**Due: 10:00 a.m. on Thursday, October 17**

*Instructions:* Submit solutions to all of the following exercises. A subset of the problems will be graded. Be sure to adhere to the expectations outlined on the sheet *Guidelines for Problem Sets*. You may submit your solutions either in-class or to the Department of Mathematics (*with date and time of submission noted*).

*Exercises:* Be sure to show all of your work and fully justify your answers and reasoning.

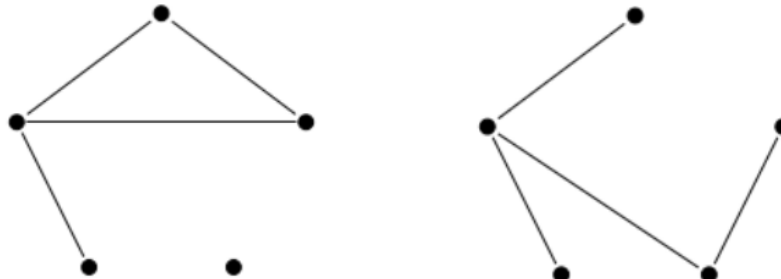
1. What does the following algorithm do?

```

Algorithm COUNTDOWN
  procedure Shout(in  $n$ )
    if  $n > 0$  then Yell  $n$ 
      Shout ( $n - 1$ )
    else Yell "Blastoff!"
    endif
  endpro
  Shout(10)

```

2. Consider the algorithm EUCLID from class.
  - (a) Write the trace of the algorithm with inputs  $(m, n) = (1239, 735)$ . Organize the trace in a table with 4 columns labelled *num*, *denom*, *quot*, *rem*.
  - (b) What is the output of the algorithm with the input values from part (a)?
3. Write an algorithm which has inputs  $(m, n)$ , where  $m, n$  are both positive integers, and outputs the quotient and remainder  $(q, r)$  of dividing  $m$  by  $n$  without using division.
4. Use induction to prove that the HANOI algorithm from class of an  $n$ -disk tower of the Hanoi problem requires  $2^n - 1$  moves.
5. Determine if the following two graphs are isomorphic. Justify your answer.



6. Draw all non-isomorphic simple graphs on 5 vertices with four edges.
7. Determine whether a simple graph exists with the following degree sequences. Give reasons if one does not exist, and draw a simple graph when one does exist.
- (a)  $d = (5, 4, 3, 3, 2, 2)$
  - (b)  $d = (4, 3, 3, 2, 2)$
  - (c)  $d = (4, 3, 2, 1, 0)$