

1. [6 pts - 2 each] Evaluate the following expressions by hand, using your calculator only to multiply or divide. Show work.
  - (a)  $C(7, 3)$
  - (b)  $P(300, 4)$
  - (c)  $C(6, 0)$
  
2. [12 pts - 3 each] Identify each situation below as indicating a combination or a permutation, then write your preferred notation for expressing the answer. **Do Not Evaluate.**
  - (a) I have a box of 28 crayons and need to give my nephew a handful of 6 to amuse himself. How many options do I have?
  - (b) I'm picking 3 of my first-graders to be teacher's helpers this week. There are 20 children in the class. How many options do I have?
  - (c) Coffaro's makes their calzones with 3 pizza toppings inside. There are 15 toppings on the menu. How many options do I have for my calzone at lunch?
  - (d) My second-grade class is studying flags of the world, and we'll be designing our own with three different-colored horizontal stripes. We have a box of 15 colored markers. How many options do we have for our flag design?
  
3. [4 pts] Use notation to express the seventh row of Pascals' Triangle.
  
4. [12 pts - 4, 8 each] Use the Binomial Theorem to find the numerical coefficient of  $x^6$  in each expression below. Do not evaluate your coefficients.
  - (a)  $(3x - 2y)^9$
  - (b)  $(x^2 + 3/x)^{21}$
  
5. [10 pts - 2, 4 each] A security code consists of 3 letters, followed by either 2 or 3 digits, then another letter. Repeated letters and digits are allowed.
  - (a) How many different security codes are possible? Do not evaluate.
  - (b) How many security codes do not use the number 0? Do not evaluate.
  - (c) How many security codes use at least one 0? Do not evaluate.

continued on back

6. [14 pts - 4, 6 each] The game of Mastermind involves putting four colored pegs in a row. The pegs come in six different colors, and colors may be repeated.
- (a) How many Mastermind arrangements have the Pegs 1 and 4 the same color?
  - (b) How many have the Pegs 1 and 4 the same color while Pegs 2 and 3 are different colors from each other and from Pegs 1 and 4?
  - (c) How many have 2 pegs somewhere that are the same color while the other 2 pegs are different from each other and from the matching pair?
7. [12 pts - 4 each] Five first-graders, 4 second-graders, and 3 third-graders are to sit in a row.
- (a) How many seating arrangements have all the first-graders together?
  - (b) How many have a third-grader on each end?
  - (c) How many do not have a first-grader on either end?
8. [8 pts - 4 each] How many 5-card hands, drawn from a regular deck of cards have...
- (a) all the cards being of the same suit?
  - (b) all 4 suits represented?
9. [15 pts - 3 each] Draw graphs having the following characteristics, if possible. If not, tell why.
- (a) 6 vertices, 2 of which are isolated
  - (b) the degree sequence 5,3,2,2,1
  - (c) the degree sequence 5,5,2,2,2
  - (d) 4 vertices, complete
  - (e)  $V = \{v_1, v_2, v_3, v_4\}$  and  $E = \{v_1v_2, v_1v_3, v_2v_3\}$
10. (a) [3 pts] Clearly state Euler's Proposition regarding the degree sequence of a graph.
- (b) [4 pts] Use Euler's Proposition to explain why a graph having 25 vertices and 152 edges must have at least one vertex incident on more than 12 edges.