CMSC 203
Exam 2
November 5, 2013

If you find yourself spending too long on a problem, skip it and move on to the next one. For all problems, partial credit will be given for incorrect answers only if an explanation is included.

Someone spilled all these equations all over the page. You may find them helpful.

$$n^r \qquad k(r-1)+1 \qquad \binom{n+1}{k} = \binom{n}{k-1} + \binom{n}{k}$$

$$\frac{n!}{n_1!n_2!\ldots n_k!} \qquad \frac{n!}{(n-r)!}$$

$$\frac{n!}{r!(n-r)!} \qquad \frac{(n+r-1)!}{r!(n-1)!} \qquad \lceil \frac{n}{k} \rceil \geq r$$

Page	Points	Score
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5	15	
6	15	
7	10	
8	15	
Total:	100	

1 Gimme Points (5 bonus points)

0. Draw a picture of you teaching your favorite pet animal how to count. (5)
(Make you sure draw something, but don't waste too much time on this)

2 Complexity (15 points)

1. You are going to a very large party, and are provided a list of outfits everyone will be wearing. Assuming an outfit consist of a shirt and a pair of pants, write an algorithm that will search your drawer of shirts and your drawer of pants for a outfit combination that nobody else will be wearing. Write your answer in **pseudocode**. You may assume outfits can somehow be ordered. (10)

2. What is the asymptotic analysis (big-O) of the procedure you gave above? (5)

3. If you wanted to sort your clothes, what sort would you use and why? (5)

3 Induction (20 points)

4. Which amounts of money can be formed using just two-dollar bills and five-dollar bills? (5)

5. Prove your answer above using strong induction. (15)

4 Recursion (15 points)

6. Develop a recursive algorithm for finding the sum of the first n odd positive integers. (5)

7. Prove the recursive algorithm you found above is correct. (10)

5 Counting (25 points)

8. Show that among any group of five (not necessarily consecutive) integers, there are two with the same remainder when divided by 4. (10)

9. A club has 10 members. How many ways are there to choose a president, vice president, secretary, and treasurer of the club, where no person can hold more than one office? (5)

10. How many students are in a class if there are 38 computer science majors, 23 mathematics majors, and 7 joint majors (assuming the class consists of no other majors, and a student is still considered a computer science or mathematic major if they are joint majoring)? (5)

11. How many ways are there to select 3 candies from a bag of Snickers, Butterfingers, Twix bars, Tootise Rolls, and Almond Joys (assuming you like all these candies)? (5)

6 Binomial Expansion (15 points)

12. Using **Pascal's Triangle**, and find the complete binomial expansion of $(x+y)^8$. Include your diagram of Pascal's Triangle and the full expansion. (10)

13. Find the coefficient of x^8y^2 for $(x+y)^{10}$. (5)