Math 55 Section Worksheet

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1 Warm-Up

Try to recall the following concepts *without* looking at your notes.

(a) What is the *stars and bars* argument? What do the stars represent? What do the bars represent? What is the formula? Can you think of an example in which to use this counting method?

(b) What is a *sample space*? What is an *event*?

(c) Let E_1, E_2 be events in a sample space S. Do you remember a formula for $p(E_1 \cup E_2)$?

2 Let's (probabilistically) Count!

1. How many positive integers less than $1,000,000$ have exactly one digit equal to 9 and have a sum of digits equal to 13?

2. What is the probability that a card selected at random from a standard deck of 52 cards is an ace or a heart?

3. In poker, a 3-of-a-kind consists of 3 cards of the same rank and 2 cards of two other ranks. A 2-pair consists of 2 cards of the same rank, 2 cards of another rank, and 1 card of a third rank. What is the probability that in a 5 card hand, you get a 3-of-a-kind? What is the probability that you get a 2-pair?

4. I flip a coin 10 times. The first 9 times come up heads. What is the probability that the 10th flip is a head?

5. Find the probability of winning a lottery by selecting the correct six integers, where the order in which these integers are selected does not matter, from the positive integers not exceeding 50.

6. Which is more likely: rolling a total of 8 when two dice are rolled or rolling a total of 8 when three dice are rolled?

7. Find someone in this class. Explain to them the Monty Hall problem and why it's advantageous to switch doors when prompted.

3 Bonus

The following is called the *twelvefold way* in combinatorics. Let X, N be finite sets of size x, n, respectively. Below, "in/distinguishable" means that the elements of the set either can or cannot be distinguished from each other. They are still distinct elements, there just might not be a difference between them. (think k different-brand candies versus k candies all of the same brand). Try to fill out the marked entries of the table:

	# of $f : N \to X$	# of injective $f : N \to X$	# of surjective $f : N \to X$
N distinguishable X distinguishable	(a)	(b)	
N indistinguishable X distinguishable	(c)	(d)	(e)
N distinguishable X indistinguishable		(f)	
N indistinguishable X indistinguishable		(g)	

Bonus: Try to fill out the remainder of the table.