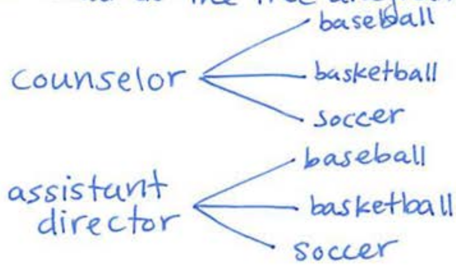
SM2 Chapter 5 Practice Test
Probability and Statistics

Name____________________________________
Period __________ Date____________

Represent the sample space for the following by writing it as a set AND by making a tree diagram.

1) Jeremy could go to baseball, basketball, or soccer camp as a counselor or an assistant director.

(you could do the tree diagram in a different way)



{baseb. counselor, basket b. couns., soccer couns., baseb. A.D., basket b. A.D., soccer A.D.}

Find the number of possible outcomes for each situation * Fundamental counting principle - # of all possible outcomes can be found by multiplying # of possible outcomes for each stage or event (or category)*

2) Eva is shopping for school supplies. She has a choice of one of each of the following: 6 backpacks, 8 notebooks, 3 pencil cases, 3 brands of pencils, 8 brands of pens, 4 types of calculators, and 4 colors of highlighters. How many different choices does she have for school supplies?

backpacks	notebooks	Pencil case	pencils	Pens	Calc.	highlighters
6	8	3	3	8	4	4

$6 \cdot 8 \cdot 3 \cdot 3 \cdot 8 \cdot 4 \cdot 4 = \boxed{55{,}296}$

3) Chloe is buying a laptop. She has a choice of 3 hard drive sizes, 3 processor speeds, 4 colors, 2 screen sizes, 2 warranty options, and 4 cases. She knows she wants a blue laptop with the longest warranty. How many choices does she have for laptops if she gets a blue one with the longest warranty?

hard drive	processor	color	screen	warranty	cases
3	3	1 (blue)	2	1 (longest warranty)	4

$3 \cdot 3 \cdot 1 \cdot 2 \cdot 1 \cdot 4 = \boxed{72}$

4) When two six-sided dice are rolled, there are 36 possible outcomes.

a. Find the probability that the sum is 5.

ways to get a sum of 5:

die 1	die 2
2	3
3	2
1	4
4	1

$\frac{4}{36} = \boxed{\frac{1}{9}}$ (about 11.1%)

b. Find the probability that the sum is not 5.

$P(\text{not sum } 5) = 1 - P(\text{sum } 5)$

$1 - \frac{4}{36} = \frac{32}{36}$

$1 - \frac{1}{9} = \boxed{\frac{8}{9}}$ (about 88.9%)

sum ≤ 5:

die 1	die 2
1	1,2,3, or 4
2	1,2,3
3	1,2
4	1

c. Find the probability that the sum is less than or equal to 5.

$\frac{10}{36} = \boxed{\frac{5}{18}}$ (about 27.8%)

d. Find the probability that the sum is less than 5.

sum < 5:

die 1	die 2
1	1,2, or 3
2	1 or 2
3	1

or $\underset{\text{sum} \le 5}{\frac{10}{36}} - \underset{\text{sum} = 5}{\frac{4}{36}}$

$\frac{6}{36} = \boxed{\frac{1}{6}}$ (about 16.7%)

6) A manufacturer tests 900 dishwashers and finds that 24 of them are defective. Find the probability that a dishwasher chosen at random has a defect. An apartment building orders 40 of the dishwashers. Predict the number of dishwashers in the apartment with defects.

$P(\text{defect}) = \frac{24}{900} = \boxed{\frac{2}{75}}$ about 0.027

number of defective parts out of 40: $\frac{2}{75} \cdot 40 \approx 1.07$ $\boxed{\text{about 1 defective in 40}}$

Tell whether the events are independent or dependent. Explain your reasoning.

7) You and a friend are picking teams for a softball game. You randomly choose a player. Then your friend randomly chooses a player.

Event *A*: You choose a pitcher. **Event *B*:** Your friend chooses a first baseman.

Dependent. Your friend can't choose the same person for first baseman that you chose for pitcher (the player is not "put back") so the pick of the first player does affect the pick of the second.

8) You are making bracelets for party favors. You randomly choose a charm and a piece of leather.

Event *A*: You choose heart-shaped charm first. **Event *B*:** You choose a brown piece of leather second.

Independent. The pick of a charm does not affect the pick of a piece of leather.

Determine whether the events are *independent* or *dependent*. Then find the probability.

9) A sack contains the 26 letters of the alphabet, each printed on a separate wooden tile. You randomly draw one letter, and then you randomly draw a second letter. Find the probability of each pair of events. * Independent $P(A \text{ and } B) = P(A) \cdot P(B)$

independent

a. You replace the first letter before drawing the second letter.

Event *A*: The first letter drawn is T. $\frac{1}{26}$

Event *B*: The second letter drawn is A. $\frac{1}{26}$

$$P(T \text{ and } A) = \frac{1}{26} \cdot \frac{1}{26} = \boxed{\frac{1}{676}}$$ (about 0.001 or 0.1%)

dependent

b. You do not replace the first letter tile before drawing the second letter tile.

Event *A*: The first letter drawn is P. → $\frac{1}{26}$ * Dependent $P(A \text{ and } B) = P(A) \cdot P(B|A)$

Event *B*: The second letter drawn is S. → assuming P was already drawn: $\frac{1}{25}$ Probability of B, given A

$$P(P \text{ and } S) = \underbrace{\frac{1}{26} \cdot \frac{1}{25}}_{P(P) \cdot P(S|P)} = \boxed{\frac{1}{650}}$$ (about 0.002 or 0.2%)

10) In a game, two dice are tossed and both roll a six.

$\boxed{\text{Independent}}$ $P(6 \text{ and } 6) = P(6) \cdot P(6)$ $\frac{1}{6} \cdot \frac{1}{6} = \boxed{\frac{1}{36}}$ (about 2.8%)

11) From a standard deck of 52 cards, a king is drawn and not put back in the deck. Then a second king is drawn.

$\boxed{\text{Dependent}}$ $P(K \text{ and } K) = P(K) \cdot \underbrace{P(K|K)}_{\text{prob of drawing a king if you've already drawn one}}$ $\frac{4}{52} \cdot \frac{3}{51} = \frac{1}{13} \cdot \frac{1}{17} = \boxed{\frac{1}{221}}$ (about 0.45%)

12) From a drawer of 8 blue socks and 6 black socks, a blue sock is drawn and put back. Then another blue sock is drawn.

$\boxed{\text{Independent}}$ $P(\text{blue and blue}) = \frac{8}{14} \cdot \frac{8}{14} = \frac{4}{7} \cdot \frac{4}{7} = \boxed{\frac{16}{49}}$ (about 32.7%)

13) Mina wants to buy a drink from a vending machine. In her pocket are 2 nickels, 3 quarters, and 5 dimes. What is the probability she first pulls out a quarter and then another quarter? 10 coins total

$\boxed{\text{Dependent}}$ $P(Q \text{ and } Q) = P(Q) \cdot P(Q|Q)$

(If you were getting money out to buy something, you wouldn't put it back)

$\frac{3}{10} \cdot \frac{2}{9} = \frac{6}{90} = \boxed{\frac{1}{15}}$ (about 6.7%)

Determine the probability of each event.

14) If the chance of being selected for the student bailiff program is 1 in 200, what is the probability of not being chosen?

$P(\text{not bailiff}) = 1 - \frac{1}{200}$ $\quad \frac{200}{200} - \frac{1}{200}$ $\quad \boxed{\frac{199}{200}}$ (99.5%)

15) If you have a 40% chance of making a free throw, what is the probability of missing a free throw?

100% - 40% $\quad \boxed{60\%}$ $\quad$ (or $\frac{3}{5}$)

16) Jeanie bought 10 raffle tickets. If 250 were sold, what is the probability that one of Jeanie's tickets will not be selected?

$P(\text{selected}) = \frac{10}{250}$ $\quad P(\text{NOT selected}) = 1 - \frac{10}{250} = \frac{240}{250} = \boxed{\frac{24}{25}}$ (96%)

Complete the two-way table.

17)

		Ran a Half Marathon		
		Yes	No	Total
Role	Student	12	124-12 112	124
	Teacher	7	263-112 151	7+151 158
	Total	12+7 19	263	282 (19+263)

18)

		Surfing Style		
		Regular	Advanced	Total
Gender	Male	110-24 86	24	110
	Female	77	95-77 18	205-110 95
	Total	86+77 163	24+18 42	205

Use the following table to complete part a.

19)

		Fishing License		
		Yes	No	Total
Hunting License	Yes	65	37	102
	No	177	341	518
	Total	242	378	620

a.) Make a two-way table that shows the joint and marginal relative frequencies.

relative to TOTAL (divide each by 620)

		Fishing License		
		Yes	No	Total
Hunting License	Yes	$\frac{65}{620} \approx 0.105$	$\frac{37}{620} \approx 0.060$	0.165 ($\frac{102}{620}$)
	No	$\frac{177}{620}$ 0.285	$\frac{341}{620}$ 0.55	0.835
	Total	0.390 ($\frac{242}{620}$)	0.610	1

20) Evaluate the expression. SHOW YOUR WORK. (or use calculator)

a. $_{10}P_7$ $\boxed{604{,}800}$

$\frac{10!}{(10-7)!} = \frac{10!}{3!}$ we want to cancel this

Rewrite: multiply back up to 10: $\frac{10\cdot9\cdot8\cdot7\cdot6\cdot5\cdot4\cdot\cancel{3!}}{\cancel{3!}}$

b. $_{10}C_4$ $\boxed{210}$

$\frac{10!}{(10-4)!\,4!} = \frac{10!}{6!\,4!}$ can only cancel one of them, choose bigger one (6!)

rewrite: $\frac{10\cdot9\cdot8\cdot7\cdot\cancel{6!}}{\cancel{6!}\,4!}$ $\quad \frac{10\cdot9\cdot8\cdot7}{4\cdot3\cdot2\cdot1} = \frac{5040}{24}$

c. $_{14}C_8$ $\boxed{3003}$

$\frac{14!}{(14-8)!\,8!} = \frac{14!}{6!\,8!}$ $\quad \frac{14\cdot13\cdot12\cdot11\cdot10\cdot9\cdot8!}{6!\,8!}$ $\quad \frac{14\cdot13\cdot12\cdot11\cdot10\cdot9}{6\cdot5\cdot4\cdot3\cdot2\cdot1}$ $\quad \frac{2162160}{720}$

d. $_{11}P_0$ $\boxed{1}$

$\frac{11!}{(11-0)!}$ $\quad \frac{11!}{11!}$

State whether the following is a permutation or combination situation. Then find the number of possibilities.

permutation: order makes a difference $\quad$ combination: order does not make a difference

21) Student ID numbers are 4 digits long selected from the 10 possible digits from 0 to 9. Digits cannot be repeated. How many possible identification numbers are there?

$\boxed{\text{Permutation}}$ (1234 and 2134 would be different ID #s)

$_{10}P_4 = \frac{10!}{6!} = \frac{10\cdot9\cdot8\cdot7\cdot\cancel{6!}}{\cancel{6!}}$ $\quad \boxed{5040}$

OR use fundamental counting principle (will only work for permutations)

	1st #	2nd #	3rd #	4th #	
# of possible choices	10 ·	9 ·	8 ·	7	= $\boxed{5040}$

(no repeats)

22) In chemistry lab, you need to test six samples of the twelve (your lab partner will test the rest) for your table. How many ways can you select six different samples, without testing the same sample twice?

Combination (if you test samples 1, 2, 3, 5, 7 and 9 that would be the same as testing 3, 1, 2, 5, 9 and 7 — it's still the same six samples)

$_{12}C_6 = \boxed{924}$ $\frac{12!}{(12-6)!6!} = \frac{12!}{6!6!} = \frac{12\cdot11\cdot10\cdot9\cdot8\cdot7\cdot\cancel{6!}}{6!\cancel{6!}}$ $\frac{665280}{720}$

State whether the situation is a permutation or combination. Then calculate the probability.

23) What is the probability that Cecilia, Annie, and Kimi are the first three gymnasts to perform their floor routine of the top seven? doesn't specify order

Combination

Ex. 1-C 2-A 3-K or 1-K 2-A 3-C either way they're still the first 3

total possible outcomes: $_7C_3 = \frac{7!}{(7-3)!3!} = \frac{7!}{4!3!} = \frac{7\cdot6\cdot5\cdot\cancel{4!}}{\cancel{4!}3!} = \frac{7\cdot6\cdot5}{3\cdot2\cdot1} = 35$

favorable: 1 (because only one of those groups is Cecilia, Annie, & Kimi)

$\boxed{\frac{1}{35}}$ (about 2.9%)

24) What is the probability that after all seven gymnasts perform, that Annie will get first, Cecilia will get second place, and Kimi third? (in order)

Permutation

1st A 2nd C 3rd K is different from 1st K 2nd A 3rd C

total possible for 1st, 2nd, 3rd: $_7P_3 = \frac{7!}{4!} = \frac{7\cdot6\cdot5\cdot\cancel{4!}}{\cancel{4!}} = 210$

favorable: 1 (only one of the arrangements for 1st 2nd & 3rd would be specifically 1st A 2nd C 3rd K)

$\boxed{\frac{1}{210}}$ (about 0.48%)

another way to think of it... total finishing outcomes places: $\frac{1}{7}\cdot\frac{2}{6}\cdot\frac{3}{5}\cdot\frac{4}{4}\cdot\frac{5}{3}\cdot\frac{6}{2}\cdot\frac{7}{1}$ 5040

favorable: place $\frac{1}{1}\cdot\frac{2}{1}\cdot\frac{3}{1}\cdot\frac{4}{4}\cdot\frac{5}{3}\cdot\frac{6}{2}\cdot\frac{7}{1}$ A C K 24

$\frac{24}{5040} = \frac{1}{210}$

25) What is the probability that in a row of 8 pool balls, the solid 2 and the striped 11 would be first and second from the left?

Permutation

total possible arrangements of first and second from left: $_8P_2 = \frac{8!}{6!} = \frac{8\cdot7\cdot\cancel{6!}}{\cancel{6!}} = 56$

favorable: 1 (solid 2 then striped 11)

$\boxed{\frac{1}{56}}$ (about 1.8%)

26) If you randomly place 24 photos in a photo album and you can place four photos on the first page, what is the probability that you choose the four oldest photos?

Combination (rearranging the photos would still be the same set of 4 going on the page)

total possible: $_{24}C_4 = \frac{24!}{20!\,4!} = \frac{24\cdot23\cdot22\cdot21\cdot\cancel{20!}}{\cancel{20!}4!} = \frac{255024}{24} \to 10626$ ($4\cdot3\cdot2\cdot1$)

favorable: 1 (the group of oldest 4)

$\boxed{\frac{1}{10626}}$

27) Complete the two-way frequency table for the activities chosen by 74 teenagers on an activity holiday.

joint frequencies

	Rock Climbing	Mountain Climbing	Totals
Boys	49-7 (or 47-5) 42	5	74-27 47
Girls	7	20	7+20 27
Totals	74-25 49	5+20 25	74

marginal frequencies

28) What is the is the probability that a randomly chosen teenager is a girl chose mountain climbing?

out of total

$\frac{20}{74} = \frac{10}{37}$ or ≈ 0.270

29)What is the probability that a randomly selected teenager chose rock climbing?

out of total

$\frac{49}{74}$ or ≈ 0.662

30)What is the probability that a randomly selected boy chose rock climbing?

out of total boys — boys who

$\frac{42}{47}$ or ≈ 0.894

31)What is the probability that a randomly selected teen who chose mountain climbing is a girl?

$\frac{20}{25} = \frac{4}{5}$ or 0.8