1) (3 points each) Consider a family with 3 children.

a) Write the sample space showing the different arrangements of genders for the youngest child, middle child, and oldest child.

bbb bbg bgb bgg gbb gbg ggb ggg

b) What is the probability of having at least one girl?

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2) (3 points each) Consider a standard deck of cards.

a) How many Face Cards are there?

12

b) What is the probability of picking a Face Card?

$\frac{12}{52} = \frac{3}{13}$

c) How many Clubs are there?

13

d) What is the probability of picking a Club?

$\frac{13}{52} = \frac{1}{4}$

e) How many cards are Club Face Cards?

3

f) What is the probability of picking a face card **or** a Club?

$\frac{12 + 13 - 3}{52} = \frac{22}{52} = \frac{11}{26}$

3) (4 points) At Chili's, you can pick one of 5 appetizers, one of 10 main dishes, and one of 6 desserts. How many complete meals can be made from this menu?

$5 \cdot 10 \cdot 6 =$ 300 meals

DARN IT!

4) (4 points each) Dario has a box of chocolates. There are 20 in total of which 9 are dark, 7 are salted caramel, and 4 are milk. Picking a piece at random….

a) What is the probability that the piece is dark?

$\frac{9}{20}$

b) What are the odds the piece is dark?

9 to 11

c) What is the probability that the piece is not milk?

$\frac{16}{20} = \frac{4}{5}$

d) What are the odds the piece is not milk?

16 to 4

4 to 1

44

5) (4 points each) In a room of 40 people, 15 saw the movie *Poor Things* (*PW*), 26 people saw the movie *Dune Part 2*, and 10 people saw both. Picking a person at random, what is the probability that they:

a) Saw *PW* or *Dune*? b) Saw *PW* given they saw *Dune*? c) Saw *Dune* given they didn't see *PW*?

$\frac{15+26-10}{40} = \frac{31}{40}$ $\frac{10}{26} = \frac{5}{13}$ $\frac{26-10}{40-15} = \frac{16}{25}$

6) (3 points each) Three cards are picked, one at a time, from a standard deck of cards. Find the probability that you pick a Heart first, a Diamond second, and another Heart third if…

a) The cards are not replaced: b) The cards are replaced:

$\frac{13}{52} \cdot \frac{13}{51} \cdot \frac{12}{50} = \frac{13}{850}$ $\frac{13}{52} \cdot \frac{13}{52} \cdot \frac{13}{52} = \frac{1}{64}$

7) (4 points) How many distinct permutations can be formed using all of the letters in the word SUCCESSES?

1 2 3 4 5 6 7 8 9

$\frac{9!}{4!\,1!\,2!\,2!} = 3780$

S U C E

8) (4 points each) A room is full of 12 artists, 7 financial advisors, 8 engineers, and 4 less scary clowns. A committee is to be formed that contains 12 people to rid the world of the Monday blues.

a) How many ways can you pick exactly 3 people from each group?

$C(12,3) \cdot C(7,3) \cdot C(8,3) \cdot C(4,3) = 1{,}724{,}800$

b) What is the probability that you pick exactly 3 people from each group?

$\frac{1{,}724{,}800}{C(31,12)} = \frac{1724800}{141{,}120{,}525} \approx 0.01222$

9) (3 points) Martha and Stewart are having a party where they invited 3 women and 3 men. Assuming everyone arrives at a different time, what is the probability that the women are the first three guests and the men are the last three guests?

$\frac{P(3,3) \cdot P(3,3)}{P(6,6)}$ or $\frac{3 \cdot 2 \cdot 1 \cdot 3 \cdot 2 \cdot 1}{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} = \frac{1}{20}$

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10) (3 points each) In February 2024, it was found that 65% of internet users choose Google Chrome. Picking 5 internet users, found the probability, written as a percent rounded to four decimal places, that…

a) They all use Google Chrome:

$C(5,5)(0.65)^5(0.35)^0$

$= 11.6029\%$

b) Exactly 3 use Google Chrome:

$C(5,3)(0.65)^3(0.35)^2$

$= 33.6416\%$

c) At least 3 of them use Google Chrome:

$C(5,3)(0.65)^3(0.35)^2 + C(5,4)(0.65)^4(0.35)^1 + C(5,5)(0.65)^5(0.35)^0$

$= 76.4831\%$

11) A raffle is being held where 1,000 tickets were sold for $20 each. One first place ticket brings in a prize of $500. Two second place prizes are for $200 each. Five third place prizes are for $100 each. Rounding answers (in dollars) to two decimal places…

a) (6 points) What is the expected net value of the game?

1st 2nd 3rd win

$\frac{1}{1000} \cdot 480 + \frac{2}{1000} \cdot 180 + \frac{5}{1000} \cdot 80 + \frac{992}{1000}(-20) = -\$18.60$

b) (2 points) Is the game fair to play? Why or why not?

Nope, EV was negative

12) (3 points each) Short Answer: When writing the answer to a question that give the following directions, how can you write your answer?

a) "What is the probability that…" b) "What are the odds that…"

words!

13) Extra credit: Using the language of the problem, explain the 4 reasons why #10 was a binomial probability:

1.
2. more words!
3.
4.

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