

- 1) The next flight out needs a pilot, a copilot, and a flight engineer. There are 9 personnel (all equally qualified) available to fill these positions. In how many ways can these positions be filled?

Note: Who gets which position matters.

- a) 84
- b) 504
- c) 723
- d) 729
- e) 645
- f) None of the above.

- 
- 2) Three rooms have to be painted. Each room is to be painted one color: red, green, or blue. In how many ways can this be done so that more than one color is used?

Example 1: Paint room 1 green, room 2 blue, and room 3 green.

Example 2: Paint room 1 blue, room 2 green, and room 3 green.

NOT A WAY: Paint all three rooms red.

- a) 24
- b) 12
- c) 9
- d) 26
- e) 21
- f) None of the above.

- 3) When making an online purchase of a computer, the buyer must configure the computer by selecting:
- 1) The type of cpu.
  - 2) The size of the hard drive.
  - 3) The amount of RAM.
  - 4) Whether or not to install bluetooth.

The buyer is free to select any of the 3 types of cpu, any of the 3 different sizes of hard drive, and any of the 4 RAM sizes offered. The bluetooth is either installed or not - the buyer selects "yes" or "no". How many possible configurations are there?

- a) 13
  - b) 38
  - c) 26
  - d) 68
  - e) 72
  - f) None of the above.
- 
- 4) Three poker chips are worth \$2 and two poker chips are worth \$1. A process consists of selecting these chips one at a time without replacement until either there are no chips left or the total value of the chips that have been selected is \$4 or more. An outcome of this process is a record of the value of the chip selected on each draw\*. How many records (or outcomes) are possible?

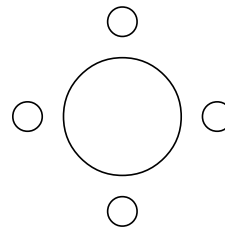
\*Example: One record (or outcome) is 122 indicating that a \$1 chip was selected, then a \$2 chip was selected, then a \$2 chip. The process terminated since  $1 + 2 + 2 \geq 4$ .

- a) 4
- b) 8
- c) 6
- d) 11
- e) 7
- f) None of the above.

- 5) Two hundred (200) mathematicians attend a math conference. Forty five (45) of these mathematicians have buck teeth (**BT**). Eighty five (85) have skinny legs (**SL**). One hundred and ten (110) of these mathematicians don't have buck teeth and don't have skinny legs. How many have buck teeth and skinny legs?
- a) 55
  - b) 110
  - c) 50
  - d) 40
  - e) 90
  - f) None of the above.

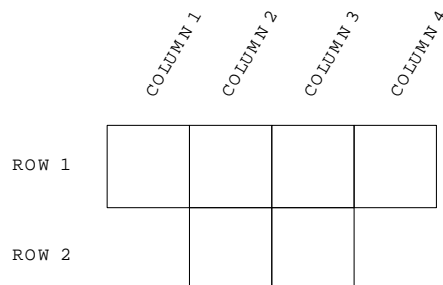
- 
- 6) A drawer contains 5 red socks and 4 blue socks. Three (3) socks are taken from the drawer, at random, without replacement. What is the probability of getting 2 red socks and 1 blue sock?
- a)  $10/21$
  - b)  $5/42$
  - c)  $1/6$
  - d)  $2/15$
  - e)  $23/84$
  - f) None of the above.

- 7) Shown to the right is a circular table with 4 chairs (shown as four small circles) arranged around it. Alice, Betty, Cindy, and Danica are seated at the table at random (one person to a chair). What is the probability that Alice and Betty are sitting directly across the table from one another?



- a)  $2/3$   
 b)  $1/6$   
 c)  $1/4$   
 d)  $1/2$   
 e)  $1/3$   
 f) None of the above.

- 8) Shown to the right are 6 boxes (i.e. 6 squares), 4 in the top row and 2 in the bottom row. If two of these six boxes are selected at random, then the probability that they are both in the same row is  $\frac{X}{C(6, 2)}$ .



Find X:

- a) 13  
 b) 10  
 c) 8  
 d) 7  
 e) 12  
 f) None of the above.

9) A hat contains 4 white slips of paper and 2 red slips of paper. A slip is drawn at random from the hat, and its color is noted. Then it is REPLACED. This process is repeated two more times - for a total of 3 draws with replacement after each draw. What is the probability that two white slips and one red slip were drawn (in any order)?

- a)  $23/27$
- b)  $4/27$
- c)  $12/27$
- d)  $4/9$
- e)  $3/5$
- f) None of the above.

---

10) How many 7 letter "words" can be formed using the letters CCCCXXX?

Example: One such word would be CXXCCCX. Another word is XCCXCXC.

- a) 210
- b) 35
- c) 70
- d) 5040
- e) 140
- f) None of the above.

- 11) The table shown below gives the values of a random variable  $X$  and the density function for  $X$ . Unknown is the value of  $p_1$ . Find the value of  $E(X)$ .

Value of $X$	Probability
-50	.10
-10	$p_1$
0	.20
10	.25
50	.20

- a) 5  
b) 10  
c) 12.5  
d) -10  
e) 6.5  
f) None of the above.
- 
- 12) On any given day, Joe arrives late to work with probability  $1/3$ . If he arrives late, he will leave work early with probability  $3/4$ . If he does not arrive late, he will leave early with probability  $1/2$ . Given that he leaves work early, what is the probability that he arrived late to work that day?
- a)  $7/12$   
b)  $1/2$   
c)  $1/3$   
d)  $1/4$   
e)  $3/7$   
f) None of the above.

13) An vase contains 3 red flowers and 4 white flowers. Two flowers are selected at random, one after the other, without replacement. If the selected flowers are both the same color, what is the probability that they are both red?

a)  $40/49$

b)  $4/7$

c)  $1/3$

d)  $9/49$

e)  $2/7$

f) None of the above.

---

14) Suppose  $A$  and  $B$  are independent events with  $Pr[A \cap B] = .2$  and  $Pr[B] = .4$ . Find  $Pr[A \cap B']$ .

a) .2

b) .3

c) .45

d) .4

e) .5

f) None of the above.

- 15) You have 10 employees. How many ways can you select 2 of them for a trip to New York and one of them for a trip to Chicago? No employee gets to go to both cities.

Example: Send employees 5 and 7 to NY, and send employee 4 to Chicago. Note that this is the same as sending 7 and 5 to NY and 4 to Chicago.

- a) 98
- b) 540
- c) 224
- d) 53
- e) 360
- f) None of the above.

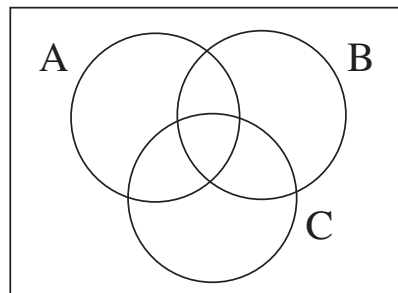
- 16) Suppose  $A, B$ , and  $C$  are sets with:

$$n(A) = 100 \quad n(B) = 80 \quad n(C) = 70$$

$$n(A \cap B) = 20 \quad n(B \cap C) = 15$$

$$n(A \cap B \cap C) = 5 \quad n(A \cup B \cup C) = 190$$

Find  $n(A \cup B)$ .



- a) 135
- b) 130
- c) 160
- d) 150
- e) 120
- f) None of the above.



- 17) A box contains red, green, and blue blocks. For every red block in the box there are two green blocks in the box (i.e. there are twice as many green blocks as red). For every blue block there are three green blocks. A block is selected at random from the box. What is the probability that it is NOT red?
- a)  $5/7$
  - b)  $2/3$
  - c)  $7/10$
  - d)  $3/4$
  - e)  $8/11$
  - f) None of the above.

- 
- 18) A group of five kids line up at random to get into a movie theatre. Two of the five kids are 8 years old and three are 9 years old. What is the probability that the two 8 year olds are first in line (i.e the 9 year olds are behind them)?
- a)  $5/20$
  - b)  $6/20$
  - c)  $8/20$
  - d)  $10/20$
  - e)  $2/20$
  - f) None of the above.

- 19) An unfair coin is flipped 20 times. On each toss, the probability of getting a heads is .7. Let  $X = \# \text{ of heads} - \# \text{ tails}^*$  that occur in the 20 tosses. Find  $E(X)$ .

\*Restated:  $X$  is the number of heads minus the number of tails.

- a) 8
- b) .4
- c) 0
- d) 17
- e) 14
- f) None of the above.

- 
- 20) A bowl contains 6 red marbles and 3 blue marbles. Three marbles are drawn from the bowl, at random, one after another, without replacement. What is the probability of getting a red marble on the first draw, then a blue on the second, then a red on the third draw?

- a)  $4/27$
- b)  $36/56 = 9/14$
- c)  $10/56 = 5/28$
- d)  $15/56$
- e)  $12/56 = 3/14$
- f) None of the above.

- 21) A password consists of 5 characters in a row. Three of these characters must be a 1, 2, and/or 3. Two of these characters must be an a, b, c, and/or d. How many passwords are possible?

Examples: ac332, 3c2d3, 123ab, 1bb11.

- a)  $5! = 120$
- b)  $10 \cdot 5! = 1200$
- c)  $10 \cdot 3! \cdot 4! = 1440$
- d)  $20 \cdot 3! \cdot 4! = 2880$
- e)  $10 \cdot 3^3 \cdot 4^2 = 4320$
- f) None of the above.

- 
- 22) Using 3 of the 7 letters ABCDEFR, how many words\* can be formed that have the letter R in them? Note: A letter may NOT be used twice.

\*Here are 4 such words: DFR, RDF, ARC, CRA.

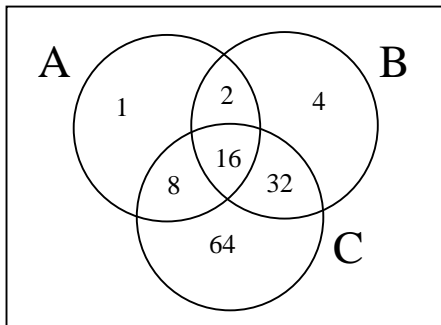
- a) 210
- b) 90
- c) 30
- d) 33
- e) 120
- f) None of the above.

- 23) There are 6 red socks and 3 black socks in a drawer. Three of the socks are drawn out at random, one after another, without replacement. What is the probability that at least one sock of each color was drawn?

For your convenience, all fractions are listed in reduced form as well as a form that may or may not appear in your calculations.

- a)  $64/84 = 16/21$   
 b)  $503/504$   
 c)  $63/84 = 3/4$   
 d)  $384/504 = 16/21$   
 e)  $483/504 = 23/24$   
 f) None of the above.

- 24) Consider the following Venn diagram for sets A, B, C. Shown in this diagram are the number of elements in each indicated subset. How many elements are in the set  $(C' \cap B) \cup A$ ?



- a) 33  
 b) 31  
 c) 38  
 d) 1  
 e) 123  
 f) None of the above.

- 25) Three 200 pound people and one 100 pound person wait for an elevator. When it arrives, two of these four people are selected at random to get on the elevator. What is the **expected total weight** of these **two** passengers?
- a) 400
  - b) 350
  - c) 325
  - d) 312.5
  - e) 275
  - f) None of the above.