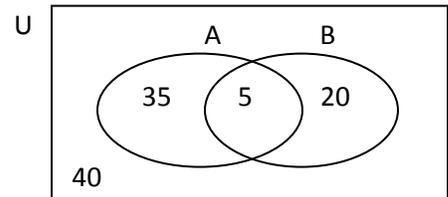


Math Analysis CP Probability
WS – Sets and Venn Diagrams

Complete each problem on a separate piece of paper.

1. Use the Venn Diagram at right to determine the number of elements in each set:

- a. A b. U c. B d. A'
 e. B' f. U' g. $A \cup B$ h. $A \cap B$
 i. $A' \cap B$ j. $A \cap B'$ k. $(A \cup B)'$ l. $(A \cap B)'$



2. A marketing survey of 1,000 car commuters found that 600 listen to the news, 500 listen to music, and 300 listen to both. Let

N = Set of commuters in the sample who listen to news
 M = Set of commuters in the sample who listen to music

- a. Draw a Venn Diagram to represent the information
 b. How many elements are in each of the following sets?

- i. $N \cup M$ ii. $N \cap M$ iii. $(N \cup M)'$ iv. $(N \cap M)'$ v. $N' \cap M$ vi. $N \cap M'$

- c. How many commuters are in each of the following sets?
 i. Commuters who listen to either news or music
 ii. Commuters who listen to both news and music
 iii. Commuters who do not listen to either news or music
 iv. Commuters who do not listen to both news and music
 v. Commuters who listen to music but not news
 vi. Commuters who listen to news but not music

3. 150 Analysis students were asked if they were going to take Statistics or Discrete Math during their senior year. 80 students said Statistics, 60 students said Discrete, and 10 students said they will be taking both math courses. Let

S = number of students who will take Statistics
 D = number of students who will take Discrete

Describe in words the sets defined by each of the following AND find the number of students in each set.

- a. S b. D c. S' d. D'
 e. $S \cup D$ f. $S \cap D$ g. $S' \cap D$ h. $S \cap D'$
 i. $(S \cup D)'$ j. $(S \cap D)'$

4. In a study to determine employee views about an upcoming strike, 1000 employees were selected at random and classified by their method of payment (H= Hourly, S = Salary, P = Percentage of profits) and whether they were in favor of the strike (Y = Yes, N= No). The responses are summarized below :

	Hourly	Salary	Percentage of Profits
Yes to Strike	400	180	20
No to Strike	150	120	130

Find the number of employees in each set AND describe the set in words:

- a. H b. S c. $S \cup P$ d. Y
 e. $H \cap Y$ f. $H \cup Y$ g. $S \cup N$ h. $S \cap N$
 i. $S \cap P$ j. $Y \cup N$

Math Analysis CP

WS – Probabilities of Compound Events

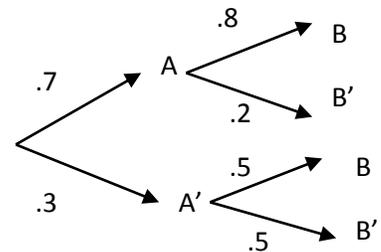
- Determine if each event is independent or dependent. Then find its probability.
 - The probability of drawing a black card from a deck, replacing it, and then drawing another black card.
 - The probability of drawing two cards from a deck that are both aces.
- Determine if each event is mutually exclusive or inclusive. Then find its probability.
 - The probability of rolling a 3 or a 6 on one toss of a number cube.
 - The probability of selecting a queen or a red card from a standard deck.
- Conrad tried out for both the volleyball team and the football team. The probability of his being selected for the volleyball team is 0.8, while the probability of his being selected for the football team is 0.75. The probability that he will be selected for both teams is 0.70.
 - What is the probability that Conrad makes the volleyball team but not the football team?
 - What is the probability that he will not make either team?
- Refer to the table in Q4 on the Sets WS.
 - Find the probability a randomly selected employee is hourly.
 - Find the probability that a randomly selected employee is in favor of the strike.
 - Are the events “hourly employee” and “in favor of the strike” mutually exclusive or inclusive? Explain.
 - Find the probability that a randomly selected employee is hourly or in favor of the strike.
- An auto club’s emergency service has determined that when club members call to report that their cars will not start, the probability that the engine is flooded is 0.5 and the probability that the battery is dead is 0.4.
 - Assuming that the events are independent, what is the probability that both the engine is flooded and the battery is dead?
 - Are the two events mutually exclusive? Explain.
 - What is the probability that the next person to report that a car will not start has a neither a flooded engine nor a dead battery?
- A fire department keeps two rescue vehicles. Due to the demand on the vehicles and the chance of mechanical failure, the probability that a specific vehicle is available when needed is 90%. The availability of one vehicle is independent of the availability of the other. Find the probability that
 - both vehicles are available at a given time
 - Neither vehicle is available at a given time
 - at least one vehicle is available at a given time.

Math Analysis CP
WS – Conditional Probabilities

- Two number cubes are tossed. Find the probability that the numbers showing on the cubes are the same, given that their sum is greater than 7.
- Three coins are tossed. Find the probability that exactly two of the coins show tails, given that the third coin is a tail.
- A survey of high school students finds that 48% of the respondents like watching soccer, 66% like watching basketball and 38% like watching hockey. Also, 30% like watching soccer and basketball, 22% like watching basketball and hockey, and 28% like watching soccer and hockey. In addition, 12% like watching all three sports.
 - What is the probability that a randomly selected student only likes to watch basketball?
 - What is the probability that a randomly selected student only likes to watch hockey?
 - What is the probability a randomly selected student does not like to watch any of the three sports?
 - If a randomly selected student likes basketball, what is the probability that she also likes soccer?
 - If a randomly selected student likes soccer, what is the probability that he also likes basketball and hockey?
- In order to test a new drug for adverse reactions, the drug was administered to 1000 test subjects with the following results: 60 subjects reported that their only adverse reaction was a loss of appetite, 90 subjects reported that their only adverse reaction was a loss of sleep, and 800 subjects reported no adverse reactions at all.
 - What is the probability that a person suffered from loss of appetite and loss of sleep?
 - What is the probability that a person suffered from loss of appetite or loss of sleep?
 - If a randomly selected test subject suffered a loss of appetite, what is the probability they also suffered a loss of sleep?
 - If a randomly selected test subject suffered a loss of sleep, what is the probability they also suffered a loss of appetite?
- Let A be the event that a randomly selected student completes his/her homework. Let B be the event that the student does well on an exam.

a) Use the probability tree to find each probability:

- | | | |
|---------------|------------------|--------------------|
| i. $P(A)$ | ii. $P(A')$ | iii. $P(B A)$ |
| iv. $P(B A')$ | v. $P(A \cap B)$ | vi. $P(A' \cap B)$ |
| vii. $P(B)$ | viii. $P(B')$ | |



- State in words what each probability above describes.
 - Are the events “a student does homework” and “a student does well on an exam” independent? Explain how you know.
- A new test has been developed to screen for a particular type of cancer. Approximately 2% of all adults are known to have this type of cancer. A random sample of 1000 adults is given the new test, and it is found that the test indicates cancer in 96% of those who actually have it. The test also indicates cancer in 1% of patients who do not have the disease.
 - Draw a tree diagram like the one above diagramming this situation.
 - What is the probability that a randomly chosen person tests positive and has cancer?
 - What is the probability that a randomly chosen person tests positive?
 - What is the probability that a randomly chosen person who tests positive with the new test does not actually have cancer?

Math Analysis CP
WS – Binomial Probabilities

1. Determine whether each scenario represents a binomial probability. Explain why or why not.
 - a) You roll a number cube 10 times and determine the probability that you obtain exactly two rolls with the number 6 face up.
 - b) You select the first five cards (without replacement) from the top of a standard deck and determine the probability of obtaining exactly three Queens.
 - c) A weighted coin is twice as likely to land heads up than tails up. You toss the coin 8 times and determine the probability of obtaining exactly six heads.
 - d) Exactly 10% of the students in your class are left handed. Your teacher selects students at random until she finds a left-handed student.

2. If six coins are tossed, find each probability
 - a) $P(3 \text{ heads})$
 - b) $P(\text{all heads or all tails})$
 - c) $P(\text{at least 2 heads})$

3. The probability that a sales representative makes a sale with any customer is 0.33. The sales rep makes eight sales contacts in one day. Assuming that individual sales are independent, find the probability that she makes
 - a) exactly 6 of her sales
 - b) less than 3 of her sales

4. Shaquille O'Neil has a long-term free throw percentage of 55%. (This means that the probability that he makes a given free throw is 0.55). Find the probability that Shaquille will make
 - a) Exactly 7 of his next 10 free throws
 - b) 7 or more of his next 10 free throws

5. Joe reads that 1 in 4 eggs contains salmonella bacteria. So he never uses more than 3 eggs when cooking.
 - a) Explain to Joe why his strategy will not keep him safe from food poisoning.
 - b) Assuming that eggs have salmonella independently of each other, what is the probability that exactly one of the eggs Joe uses will contain salmonella?
 - c) What is the probability that one or more of the eggs Joe uses will contain salmonella?

6. A 5-question multiple-choice test has 4 answer choices (A, B, C, D) for each question. A student who did no studying for the test is randomly guessing on each question.
 - a) What is the probability of answering one of the 5 questions correctly?
 - b) What is the probability of answering all 5 questions correctly?
 - c) What is the probability of answering exactly 3 questions correctly?
 - d) What is the probability of failing the quiz if a grade below 60% is a fail?
 - e) What score is the student most likely to earn on the quiz?

Probability Review

1. A survey of residents in a certain town indicates 170 own a dehumidifier, 130 own a snow blower, and, of these, 80 own both a dehumidifier and snow blower. How many own a dehumidifier or a snow blower?
2. From a group of 10 people, in how many ways can we choose a chairperson, vice chair, treasurer and secretary, assuming one person cannot hold more than one position?
3. A teacher has 14 math books on her shelf. In how many ways can the books be arranged if there are 3 (identical) Algebra books, 4 (identical) Analysis books, 5 (identical) Statistics books, and two different Calculus books.
4. A software company employs 9 sales reps and 8 technical reps. In how many ways can the company select 5 of these employees to send to a computer convention if at least 4 technical reps must attend?
5. An experiment consists of drawing a ball from a box that contains nine balls numbered 1 to 9. What is the probability that the ball number on the ball is even or divisible by 3?
6. Eight cards are drawn from a standard deck of cards. What is the probability that there are 5 face cards and 3 non-face cards?
7. In a law firm consisting of 20 lawyers, 9 are criminal lawyers, 6 are divorce lawyers and 4 can practice either criminal or divorce law. If a lawyer from the firm is chosen at random, what is the probability that he or she isn't a criminal or divorce lawyer?
8. A pair of dice is tossed. Find the probability that the two dice match given that the sum is 4.
9. Two marbles are drawn in succession out of a box that contains 3 green and 8 yellow marbles without replacement. Find the probability that exactly one green marble was drawn.
10. A little girl has 15 socks in her drawer, 7 are pink and 8 are purple. If she selects two socks at random, what is the probability that at least one of the socks is pink?
11. Each person in a group of students was identified by his/her hair color and then asked whether he or she preferred taking math classes in the morning or afternoon. The results are shown in the table below.

Class Time Preference	Blonde	Brunette	Redhead
Morning	45	25	5
Afternoon	40	20	20

- a. Find the probability that a randomly selected student from this group prefers afternoon math classes?
 - b. Find the probability that a randomly selected redhead from the group prefers afternoon math classes?
 - c. Are the events "prefers afternoon math classes" and "being a redhead" independent? Explain how you know.
12. A soccer team is to play two games in a tournament. The probability of winning the first game is 0.60. If the first game is won, the probability of winning the second game is 0.25. If the first game is lost, the probability of winning the second game is 0.15. What is the probability the team won its first game if we know the second game was lost?
 13. Each question on an 8-question multiple choice test has 5 possible answer choices, only one of which is correct. If a student randomly guesses on all 8 questions, find the probability the student gets more than 5 questions correct.
 14. Four coins are tossed. Find the probability that three are heads or two are tails.