AP Statistics – Probability Level Practice

Level I – White belt (Basic vocab and notation)

1. Provide the definition of "sample space" in your own words.

2. In general, how do you find the probability of an event?

3. Provide the notation (i.e. math symbols) that would be used to represent the following: "Probability that event A occurred"

4. Three coins are to be tossed. Provide the sample space.

5. If three coins are tossed at the same time, what is the probability of the following:
   a. P(3 heads) b. P(2 heads) c. P(1 head) d. P(0 head)

6. Provide the sample space for the following event: Ms. Renazco at the pet store uses a net to try and catch a goldfish for her daughter from the fish bowl with two fish inside.

7. Explain in simple language what it means for an event to have the probability of "$\frac{1}{3}$". Use the following words in your explanation: long run, theoretical.

8. Explain in simple language how the probability of an event changes when using "AND" instead of "OR". For example, the $P(A\ and\ B)$ vs. $P(A\ or\ B)$. Event A: Selecting from a standard deck of cards a red card. Event B: Selecting from a standard deck of cards a heart.

9. A single die is to be thrown. What is the probability that the number is prime or the number is odd?

Level 2 – Yellow Belt (More advanced vocab and some basic problems)

1. You are explaining to a friend's little sister how to find the probability of an event in general. Explain in simple language what you would say to your friend's little sister (no formulas).

2. What does it mean for two events to be independent? Provide an example using selecting two cards from a standard deck of cards.

3. Explain how to mathematically decide if two events are independent.

4. What does it mean for two events to be dependent? Provide an example using selecting two marbles from a bag.

5. What does it mean for two events to be mutually exclusive? Provide an example using the students at Gunn HS.

6. Jack and Jill Hill each bought 10 raffle tickets. Each of their three children bought 4 tickets. If 4280 tickets were sold in total, what is the probability that the grand prize winner is:
   a. Jack or Jill Hill?
   b. One of the 5 Hill family members?
   c. None of the Hills?

7. Select a woman aged 25-29 at random and record her marital status. "At random, meaning that every such woman has the same chance of being selected. The probability of any marital status is just the proportion of all women aged 25-29 who have that status – if we selected many women, this is the proportion we would get". Here is the probability model:

Marital Status	Never Married	Married	Widowed	Divorced
Probability	0.353	0.574	0.002	0.071

   a. What's the probability of a woman being not married?
   b. Never Married and Divorced are mutually exclusive events, so find the P(Never Married or Divorced).

8. You have a coin and a die. You will flip the coin, then roll the die.
   a. How many outcomes will be in your sample space? Provide the sample space.
   b. What is the probability that you would get a Heads AND a 5?
   c. What is the probability that you would get a Tails AND a 1?
   d. What is the probability that you would get a Heads then a 2 OR a Tails and a 3?
   e. How can you generalize how to calculate probability using AND, as well as probability using OR?

Level 3 – Orange Belt

1. You roll two dice.
    a. P(rolling a sum of 7)
    b. P(rolling a sum greater than 4)
    c. P(rolling a sum of 7 or 11)
    d. P(rolling a five both times)
    e. P(not rolling a five both times)
    f. P(at least one 3 appears on a die)
    g. P(A sum of 7 or 10 appears)

2. In the following situation, what must the missing probability be equal to? Explain your conclusion.

Finishing time for Homework	1 hour or less	1-2 hours	2-3 hours	More than 3
Probability	.24	.33	.28	?

What is the probability of finishing homework in two hours or less?

3. All human blood can be typed as one of O, A, B, or AB, but the distribution of the types varies a bit with race. Here is the distribution of the blood type of randomly chosen Americans.

Blood Type:	O	A	B	AB
Probability:	0.49	0.27	0.20	?

a. What is the probability of type AB blood?

b. Maria has type B blood. She can safely receive blood transfusions from people with blood types O or B. What is the probability that a randomly chosen person can donate blood to Maria?

c. If you were to randomly pick two people, what is the probability that one person would be blood type A and the other person would be blood type AB?

Level 4 – Green Belt

1. A diagnostic test for the presence of the AIDS virus has probability of 0.005 of producing a false positive test result. That is, when a person that is free of the AIDS virus is tested, the test has a 0.005 probability of falsely indicating that the virus is present. If 140 employees of a medical clinic are tested and all 140 are free of AIDS, what is the probability that at least one false positive will occur?

2. Calvin and Phoebe volunteer at different hospitals. The probability that Calvin will get mumps as a result of going to the hospital is 0.13. The probability that Phoebe will get mumps as a result of going to the hospital is 0.07. What is the probability that

a) both Calvin and Phoebe get the mumps

b) neither Calvin nor Phoebe get the mumps

Level 5 – Blue Belt

1. Two cards are drawn from a standard deck and not put back. You are interested in whether you are drawing a heart or not a heart on both draws.
   a) Draw a tree diagram and label the probabilities.

   b) Find the probability that both cards are hearts

2. A contest is being held to give away a free pizza. Contestants pick an integer at random from the integers 1 through 100. If the number chosen is divisible by 24 or by 36, the contestant wins the pizza. What is the probability that a contestant wins a pizza?

3. If P(A) = 0.5, P(B) = 0.3, and P(A or B) = 0.65, are events A and B independent?

Level 6 – Red Belt (Old Test Problem)

1. Aileen, Barbara, and Carol are the only three employees in the packaging department at a small cookie factory. Recently, the company has been receiving complaints about packages that contain broken cookies. Aileen works very fast; she is responsible for 50% of the cookie packages that leave the factory. Unfortunately, 35% of the packages that Aileen packs contain at least one broken cookie. Barbara works at a medium speed; she is responsible for 30% of the cookie packages. Only 18% of the packages that she packs contain one or more broken cookies. Carol works slowly but carefully; she is responsible for the remaining 20% of the cookie packages at the factory. Exactly 10% of the packages that Carol packs contain at least one broken cookie.
   a. Draw a well-labeled tree diagram to illustrate these cookie-packing probabilities.

   b. Find the probability that a randomly selected package of cookies from this factory contains one or more broken cookies. Show your method.

   c. Given that a randomly selected package contains at least one broken cookie, find the probability that the package was prepared by Aileen. Show your method.

Level 7 – Black Belt (Old AP)

2. Two antibiotics are available as treatment for a common ear infection in children.
   - Antibiotic A is known to effectively cure the infection 60 percent of the time.
   - Antibiotic B is known to effectively cure the infection 90 percent of the time.
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   The antibiotics work independently of one another. Both antibiotics can be safely administered to children. A health insurance company intends to recommend one of the following two plans of treatment for children with this ear infection.

   - Plan I: Treat with antibiotic A first. If it is not effective, then treat with antibiotic B.
   - Plan II: Treat with antibiotic B first. If it is not effective, then treat with antibiotic A.

   a. If a doctor treats a child with an ear infection using plan I, what is the probability that the child will be cured?

   b. If a doctor treats a child with an ear infection using plan II, what is the probability that the child will be cured?