$\qquad$ Period $\qquad$

## AP Statistics | Unit 04 - Probability \& Random Variables Review

## Multiple-Choice

1. In a population of students, the number of calculators owned is a random variable $X$ with $P(X=0)$ $=0.2, P(X=1)=0.6$, and $P(X=2)=0.2$. The mean of this probability distribution is
a) 0
b) 2
c) 1
d) 0.5
e) None of the above
2. Refer to the previous problem. The variance of this probability distribution is
a) 1
b) 0.63
c) 0.5
d) 0.4
e) None of the above
3. The number of calories in a one-ounce serving of a certain breakfast cereal is a random variable with mean 110. The number of calories in a full cup of whole milk is a random variable with mean 140. For breakfast you eat one ounce of the cereal with $1 / 2$ cup of whole milk. Let $Z$ be the random variable that represents the total number of calories in this breakfast. The mean of $Z$ is
a) 110
b) 140
c) 180
d) 250
e) 195

A psychologist studied the number of puzzles subjects were able to solve in a five-minute period while listening to soothing music. Let X be the number of puzzles completed successfully by a subject. X had the following distribution:

| $\mathbf{X}$ | 1 | 2 | 3 | 4 |
| :--- | :---: | :---: | :---: | :---: |
| $\mathbf{P}(\mathbf{X})$ | 0.2 | 0.4 | 0.3 | 0.1 |

4. Using the above data, what is the probability that a randomly chosen subject completes at least 3 puzzles in the five-minute period while listening to soothing music?
a) 0.3
b) 0.4
c) 0.6
d) 0.9
e) The answer cannot be computed from the information given.
5. Using the above data, $P(X<3)$ is
a) 0.3
b) 0.4
c) 0.6
d) 0.9
e) None of the above
6. Using the above data, the mean $\mu$ of $X$ is
a) 2.0
b) 2.3
c) 2.5
d) 3.0
e) None of the above
7. Cans of soft drinks cost $\$ 0.30$ in a certain vending machine. What is the expected value and variance of daily revenue $(Y)$ from the machine, if $X$, the number of cans sold per day has $E(X)=125$, and $\operatorname{Var}(X)=50$ ?
a) $E(Y)=37.5$, and $\operatorname{Var}(Y)=50$
b) $E(Y)=37.5$, and $\operatorname{Var}(Y)=4.5$
c) $E(Y)=37.5$, and $\operatorname{Var}(Y)=15$
d) $E(Y)=37.5$, and $\operatorname{Var}(Y)=15$
e) $E(Y)=125$, and $\operatorname{Var}(Y)=4.5$
8. A rock concert producer has scheduled an outdoor concert. If it is warm that day, she expects to make a $\$ 20,000$ profit. If it is cool that day, she expects to make a $\$ 5,000$ profit. If it is very cold that day, she expects to suffer a $\$ 12,000$ loss. Based upon historical records, the weather office has estimated the chances of a warm day to be .60 ; the chances of a cool day to be .25 . What is the producer's expected profit?
a) $\$ 5,000$
b) $\$ 13,000$
c) $\$ 15,050$
d) $\$ 13,250$
e) $\$ 11,450$
9. Event A occurs with probability 0.8. The conditional probability that event $B$ occurs, given that $A$ occurs, is 0.5 . The probability that both $A$ and $B$ occurs is:
a) 0.3
b) 0.4
c) 0.625
d) 0.8
e) 1.0
10. At Lakeville South High School, $60 \%$ of students have high-speed Internet access, $30 \%$ have a mobile computing device, and $20 \%$ have both. The proportion of students that have neither highspeed Internet access nor a mobile computing device is:
a) $0 \%$
b) $10 \%$
c) $30 \%$
d) $80 \%$
e) $90 \%$
11. Suppose the amount of propane needed to fill a customer's tank is a random variable with a mean of 318 gallons and a standard deviation of 42 gallons. Hank Hill is considering two pricing plans for propane. Plan A would charge $\$ 2$ per gallon. Plan B would charge a flat rate of $\$ 50$ plus $\$ 1.80$ per gallon.
a. Calculate the mean and standard deviation of the distributions of money earned under each plan.
b. Assuming the distributions are Normal, calculate the probability that Plan $B$ would charge more than Plan A.
12. For an upcoming concert, each customer may purchase up to 3 child tickets and 3 adult tickets. Let $C$ be the number of child tickets purchased by a single customer. The probability distribution of the number of child tickets purchased by a single customer is given in the table below.

| $C$ | 0 | 1 | 2 | 3 |
| :--- | :--- | :--- | :--- | :--- |
| $P(C)$ | 0.4 | 0.3 | 0.2 | 0.1 |

a. Compute the mean and standard deviation of $C$.
b. Suppose the mean and the standard deviation for the number of adult tickets purchased by a single customer are 2 and 1.2, respectively. Assume that the number of child tickets and adult tickets purchased are independent random variables. Compute the mean and standard deviation of the total number of adult and child tickets purchased by a single customer.
c. Suppose each child ticket costs $\$ 15$ and each adult ticket costs $\$ 25$. Compute the mean and the standard deviation of the total amount spent per purchase.
3. A laboratory test for the detection of a certain disease gives a positive result 5 percent of the time for people who do not have the disease. The test gives a negative result 0.3 percent of the time for people who have the disease. Large-scale studies have shown that the disease occurs in about 2 percent of the population.
a. What is the probability that a person selected at random would test positive for this disease? Show your work.
b. What is the probability that a person selected at random who tests positive for the disease does not have the disease? Show your work!
4. USA Today gave information on seat belt usage by gender. The proportions in the following table are based on a survey of a large number of adult men and women in the United States:

## Uses seat belts regularly <br> Does not use seat belts regularly

| Male | Female |
| :--- | :--- |
| .10 | .1725 |
| .40 | .325 |

Assume that these proportions are representative of adults in the United States and that a U.S. adult is selected at random.
a. What is the probability that the selected adult regularly uses a seat belt?
b. What is the probability that the selected adult regularly uses a seatbelt given that they are male?
c. What is the probability that the selected adult does not use a seatbelt regularly given that they are female?
d. What is the probability that the selected individual is female given that they do not use a seat belt regularly?
e. When selecting a person at random from the sample, are the events "uses a seat belt regularly" and "is male" independent?
5. To start her old lawn mower, Nina has to pull a cord and hope for some luck. On any particular pull, the mower has a $20 \%$ chance of starting.
a. Find the probability that it takes her exactly 3 pulls to start the mower. Show your work?
b. Find the probability that it takes her more than 10 pulls to start the mower. Show your work.
6. A survey found that engineering was the most popular college major for male college students who were in chess club, with $42 \%$ selecting this major. Find the probability that a random sample of 200 male college chess club participants would contain more than 104 engineering majors.

