

AP Statistics - Random Variables, Expected Value and Combining Variables - Worksheet

Common Core AP STAT 4.7, AP STAT 4.8, AP STAT 4.9, HSS-MD.A.1, HSS-MD.A.2, HSS-MD.B.5 · maths-pdf.fr/en/

Name: _____ Class: _____ Date: ____/____/____

These 20 problems practice AP Statistics topics 4.7 to 4.9. You will check discrete distributions, compute expected value and standard deviation, and find the mean and standard deviation after transforming or combining random variables.

AP Statistics · Common Core State Standards: **AP STAT 4.7, AP STAT 4.8, AP STAT 4.9, HSS-MD.A.1, HSS-MD.A.2, HSS-MD.B.5**

Exercise 1 - Valid distribution?

Is each a valid probability distribution? (a) 0.2, 0.3, 0.4, 0.2 (b) 0.1, 0.5, 0.4 (c) 0.6, -0.1, 0.5

Exercise 2 - Missing probability

X is the number of goals scored in a soccer game. $P(0) = 0.1$, $P(1) = 0.4$, $P(3) = 0.2$, and $P(2)$ is missing (only these values are possible). Find $P(2)$.

Exercise 3 - Find a probability

x	1	2	3	4	5
P(x)	0.3	0.25	0.2	0.15	0.1

Items in an order.

Using the distribution of X (items in an order), find $P(X \geq 3)$ and $P(X < 3)$.

Exercise 4 - Expected value

x	1	2	3	4	5
P(x)	0.3	0.25	0.2	0.15	0.1

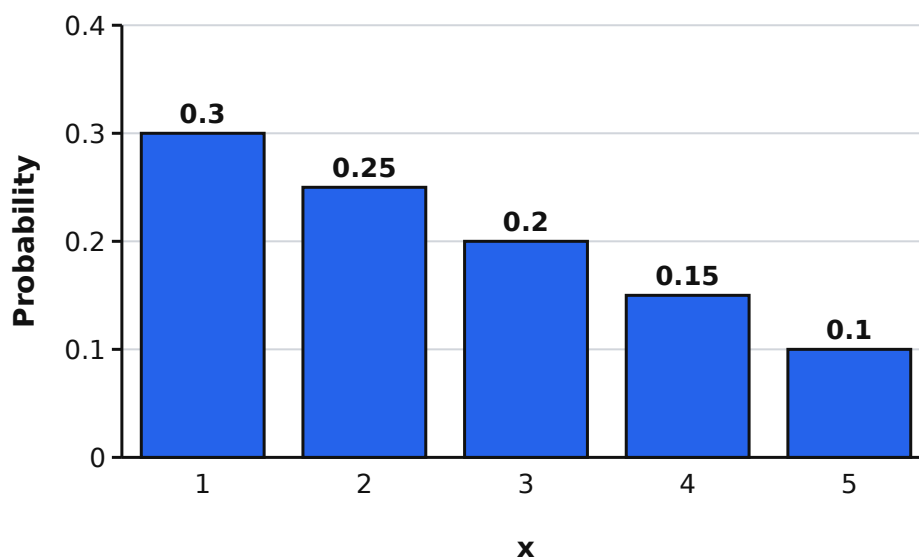
Probability distribution of X , the number of items in an order.

Compute the mean number of items per order.

Exercise 5 - Interpret the mean

A game has expected winnings of $-\$0.50$ per play. Interpret this in context.

Exercise 6 - Standard deviation



Probability histogram: skewed right, with mean 2.5 items.

Compute the standard deviation of X from the table and interpret it.

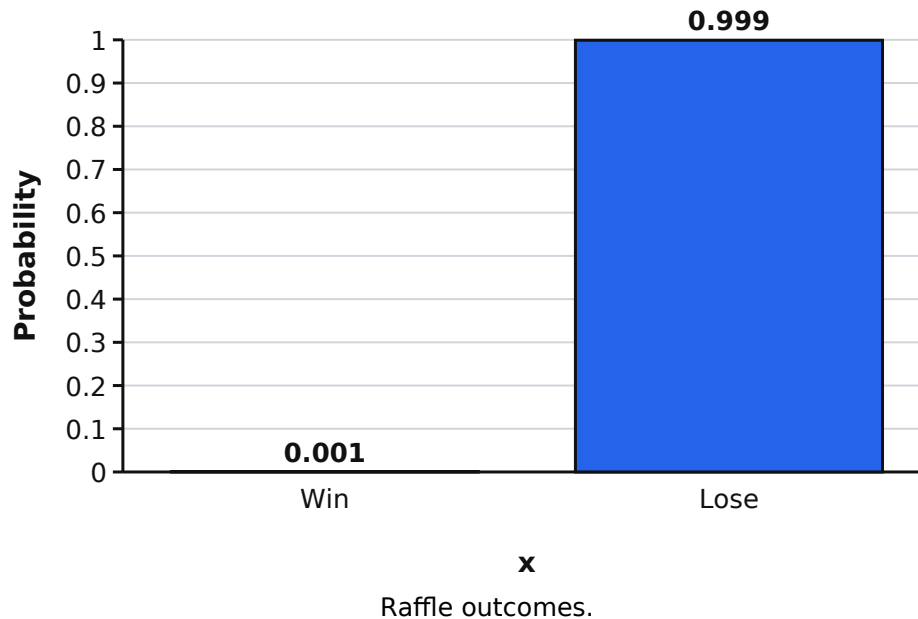
Exercise 7 - Expected winnings

Outcome	Net gain	Probability
Win	+\$4	0.2
Lose	-\$1	0.8

The carnival game.

Sofia pays \$1 to play a game. She wins \$5 (net +\$4) with probability 0.20 and loses her dollar (net -\$1) with probability 0.80. Find the expected net gain.

Exercise 8 - Raffle



A raffle sells 1,000 tickets at \$5 each, with one \$500 prize. Find the expected net gain of one ticket, in dollars.

Exercise 9 - Linear transformation

Shipping costs $Y = 3 + 2X$ dollars where X is the number of items, with mean 2.5 and standard deviation 1.432. Find the mean and standard deviation of Y .

Exercise 10 - Sum of means

The time to bake a cake X has mean 40 minutes and standard deviation 3. The time to decorate Y has mean 25 minutes and standard deviation 4. The times are independent. Find the mean and standard deviation of the total time.

Exercise 11 - Difference

Using the baking and decorating times above, find the mean and standard deviation of $X - Y$.

Exercise 12 - Standard deviations do not add

Diego says the standard deviation of the total time is $3 + 4 = 7$. Correct him.

Exercise 13 - $2X$ versus $X + X$

X has standard deviation 6. Y is an independent copy of X . Compare the standard deviation of $2X$ with the standard deviation of $X + Y$.

Exercise 14 - Insurance

An insurance company charges \$400 per year. In a year, a customer has no claim (probability 0.95), a \$3,000 claim (0.04), or a \$20,000 claim (0.01). Find the expected profit per customer.

Exercise 15 - Total of two games

In game A, expected winnings are \$2 with standard deviation \$3. In game B, they are \$1 with standard deviation \$4. They are independent. Find the mean and standard deviation of total winnings.

Exercise 16 - Weights

A box has weight with mean 12 oz and sd 0.5 oz. Ten independent boxes are packed in a case. Find the mean and standard deviation of the weight of the 10 boxes.

Exercise 17 - Normal approximation

The time for a customer to check out has mean 4 minutes and sd 1 minute. If the total time for 2 independent customers is approximately normal with mean 8 and sd 1.414, find the probability that it exceeds 10 minutes.

Exercise 18 - Change of units

X is temperature in degrees Celsius with mean 20 and sd 4. Fahrenheit is $F = 1.8C + 32$. Find the mean and standard deviation of F .

Exercise 19 - Complete a distribution

x	10	20	30	40
P(x)	0.4	0.3	0.2	?

Incomplete distribution.

X has values 10, 20, 30, 40 with $P(10) = 0.4$, $P(20) = 0.3$, $P(30) = 0.2$. Find $P(40)$ and the mean.

Exercise 20 - Multi-step

A vending machine dispenses X cups of coffee in a minute with $P(0) = 0.5$, $P(1) = 0.3$, $P(2) = 0.2$. Each cup brings in \$1.50 and the machine costs \$0.40 per minute to run. Find the expected profit per minute.