

Probability Distribution can be a table, graph, or equation that links each possible outcomes of an event with its probability of occurring.

- The probability of each outcome must be between 0 and 1.
- The sum of all the probabilities must equal 1.

Making a Probability Distribution

Example 1: Bakery

A bakery is trying a new recipe for the fudge deluxe cake. Customers were asked to rate the flavor of the cake on a scale of 1 to 5, with 1 being not tasty, 3 being okay, and 5 being delicious. Use the frequency distribution show to construct and graph a probability distribution.

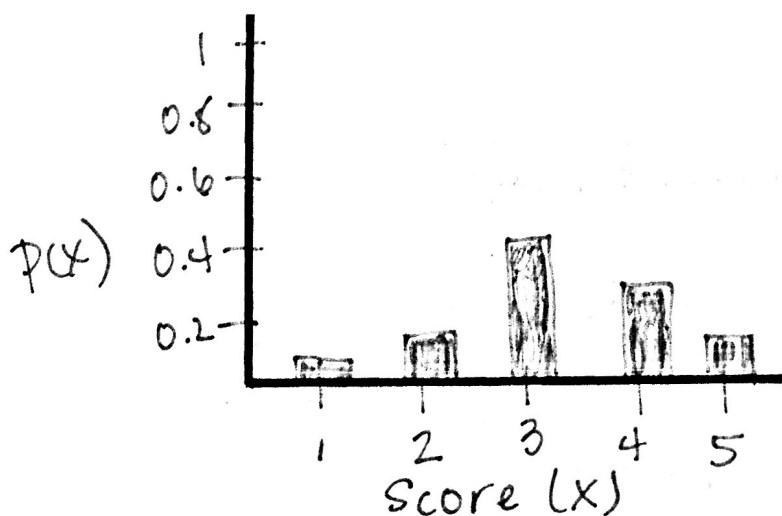
Step 1: Find the probability of each score.

Score, x	Frequency	Probability
1	1	$1/50 = 0.02$
2	8	$8/50 = 0.16$
3	20	$20/50 = 0.40$
4	16	$16/50 = 0.32$
5	5	$5/50 = 0.10$

total: 50

total: 1

Step 2: Graph the score versus the probability.

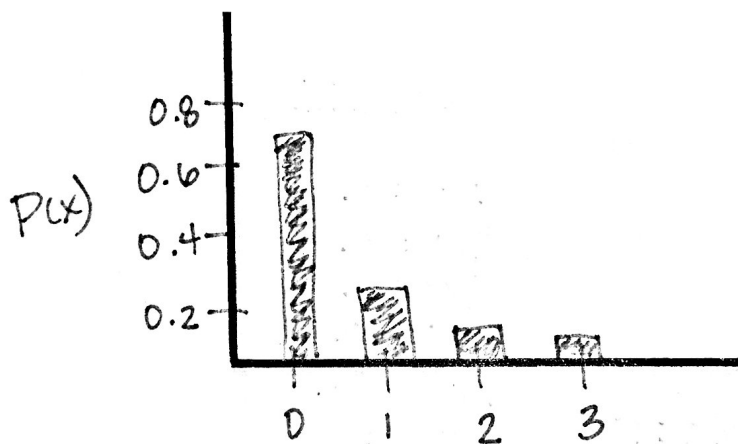


Example 2: Car Sales

A car salesperson tracked the number of cars she sold each day during a 30-day period. Use the frequency distribution of the results to construct and graph a probability distribution for the random variable x , rounding each probability to the nearest hundredth.

x Cars Sold, x	Frequency	P $P(x)$
0	20	$20/30 = 0.67$
1	7	$7/30 = 0.23$
2	2	$2/30 = 0.07$
3	1	$1/30 = 0.03$

total: 30



Expected Value

In a random experiment, the values of the n outcomes are $x_1, x_2, x_3, \dots, x_n$ and the corresponding probabilities of the outcomes occurring are

$P_1, P_2, P_3, \dots, P_n$.

The expected value (EV) of the experiment is given by:

$$EV: P_1(x_1) + P_2(x_2) + P_3(x_3) + \dots + P_n(x_n)$$

To calculate expected value:

- Start with the probability distribution or create it if you don't have it.
- Multiply the value of each outcome by its probability.
- Add up all those products.
- The sum is the Expected value.

Example 3: Fundraisers

At a raffle, 500 tickets are sold at \$1 each for three prizes of \$100, \$50, and \$10. What is the expected value of your net gain if you buy a ticket?

Gain, X	\$100 - \$1 or <u>\$99</u>	\$50 - \$1 or <u>\$49</u>	\$10 - \$1 or <u>\$9</u>	\$0 - 1 or <u>-\$1</u>
Probability P(x)	$\frac{1}{500} = 0.002$	$\frac{1}{500} = 0.002$	$\frac{1}{500} = 0.002$	$\frac{497}{500} = 0.994$

$$EV: 0.002(99) + 0.002(49) + 0.002(9) + 0.994(-1)$$

$$EV: -0.68¢$$

Example 4: Water Park

A water park makes \$350,000 when the weather is normal and loses \$80,000 per season when there are more bad weather days than normal. If the probability of having more bad weather days than normal this season is 35%, find the park's expected profit.

Gain, x	350,000	-80,000
Probability, P(x)	0.65 1-0.35	0.35

$$EV: 0.65(350,000) + 0.35(-80,000) = \$199,500$$

Example 5: MP3 Players

Construct a probability distribution and find the expected value:

Students were asked how many MP3 players they own.

Players, x	Frequency	P(x)
0	9	$\frac{9}{42} = 0.214$
1	17	$\frac{17}{42} = 0.405$
2	9	$\frac{9}{42} = 0.214$
3	5	$\frac{5}{42} = 0.119$
4	2	$\frac{2}{42} = 0.048$

$$EV: 0.214(0) + 0.405(1) + 0.214(2) + 0.119(3) + 0.048(4) = 1.382$$

Calculator: STAT → ENTER → Put outcomes in L₁, Probability in L₂

STAT → CALC → 2 var stats → scroll to Σxy