**Probability Quiz**

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1. Canada has two official languages, English and French. Choose a Canadian at random and ask, “What is your mother tongue?” Here is the distribution of responses (combining many separate languages from the broad Asian/Pacific region):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Language | English | French | Asian/Pacific | Other |
| Probability | 0.57 | ? | 0.07 | 0.12 |

a. What probability should replace “?” in the distribution?

.24

b. What is the probability that a Canadian’s mother tongue is not English? Explain how you computed your answer.

1 - .57 = .43

c. Suppose that you randomly chose two Canadian’s. What is the probability English is the mother tongue for both of these Canadians? Explain how you got your answer.

.57\*.52 = .3249

2. Suppose an individual plays a gambling game where it is possible to lose $1.00 (it cost $1.00 to play the game), break even, win $4.00, or win $6.00 each time she plays. The probability distribution for each outcome is provided by the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcome | -$1.00 | $0.00 | $4.00 | $6.00 |
| Probability | 0.50 | 0.30 | 0.10 | 0.10 |

a. Find *μ* , the mean outcome (or expected outcome) for this game. Show your calculations.

-1\*.5 + 0\*.3 + 4\*.1 + 6\*.1 = .5

b. Find the standard deviation *σ*. Show your calculations.

(-1-.5)^2(.5) + (0-.5)^2(.3) + (4-.5)^2(.1) + (6-.5)^2(.1) = 5.45 = Variance

Sqrt(5.45) = 2.334524 = stdev

c. What is the probability of winning a positive amount if one game is played?

.1 + .1 = .2

d. Two players are chosen at random. Let *X* be the winnings for Player 1, and *Y* the winnings for Player 2. Find the mean and standard deviation for their total winnings: *X* + *Y*.

meanX = .5 meanY= .5

.5 = -1$

-1$ + -1$ = -2$

stdevX = 2.334524

stdevY = 2.334524

2.334524 + 2.334524 = 4.669047012$

3. Let *X* denote the time (in minutes) that it takes a fifth-grade student to read a certain passage. Suppose that the mean and standard deviation of *X* is *μ* = 3 min and ** = 0.9 min, respectively, and that the distribution is approximately normal.

a. A fifth grade student is chosen at random. What is the probability that it will take the student more than 3.4 minutes to read the passage?

A picture containing chart

Description automatically generated

.328

b. What is the probability that a randomly selected fifth-grade student will take between 2.9 and 3.4 minutes to read the passage?

Icon

Description automatically generated with medium confidence

.2158

c. Students above the **upper** 25th percentile will be put into a special reading group to help improve their reading speed. What is (in minutes) the upper 25th percentile?

A picture containing text

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3.607041

4.



Imagine rolling a “fair” twelve-sided die. The outcome is the number on the side facing up. The sample space is *S* = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}. Consider the following events:

* *A* = {1, 2, 3, 4, 5, 6,7}
* *B* = {3, 6, 9, 12}
* *C* = {2, 4, 6, 8, 10, 12}
* *D* = {1, 3, 5, 7, 9, 11}

a. Find the probability that both *A* and *B* occur:.

P(A) = 7/12

P(B) = 4/12

 = {3,6} = 2/12 = 1/6 = .16667

b. Are events *A* and *B* independent? Justify your answer.

7/12 = .583333

4/12 = .333333

.58333\*.33333 = .19441

A and B are Independent because P(A)xP(B) does not equal  (answer a)

c. Find the probability that event C or D occurs: .

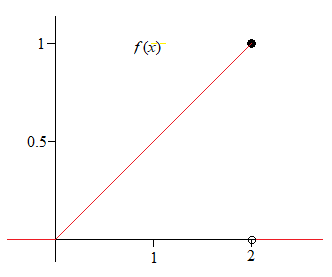
{1,2,3,4,5,6,7,8,9,10,11,12} = 12/12 = 1

d. Find the probability that event (*C* or *D*) does not occur: .

1-1 = 0

5. A history book is put on reserve in Eastern’s library. Suppose the time (in hours), *x*, for which the book is checked out can be described by the following density function (with graph shown below its equation):





a. Justify that this is a “legal” density function. (You can use calculus (integration) or geometry as part of your justification.)

A picture containing text, shoji, clock, orange

Description automatically generated Chart

Description automatically generated with medium confidence= 1

b. A student is chosen at random from students who have checked out this history book. What is the probability that the time, *x*, for which the book is checked out is between ½ hour and 1 hour? You can use calculus (integration) or geometry to determine the answer. Show your work.

A picture containing text, clock, public, tiled

Description automatically generatedTable, calendar

Description automatically generatedA picture containing calendar

Description automatically generated 18.75%

c. What is the mean *μ* for this distribution? You will need to use integration. You can do the computations by hand, or use software such as Maple or a TI-89 calculator. (You can also compute definite integrals using a TI-84; see <https://brownmath.com/ti83/integr.htm>). Explain how you determined your answer. (If you want to use the TI-89 that is accessible online, and don’t know how to use it to integrate, see the primer at the end of this question.)

A picture containing text, shoji, wall, toilet

Description automatically generatedA picture containing text, shoji

Description automatically generated mean = .145833

d. What is the standard deviation for this distribution? Explain how you determined your answer. (Again, you will need to use integration.)

Text

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A picture containing text, clock

Description automatically generated -( A picture containing text, shoji, wall, toilet

Description automatically generated )^2 =

A picture containing text, shoji, tub, bath

Description automatically generated - (A picture containing text, shoji

Description automatically generated)^2 = 1.9787 = Variance

Sqrt(1.9787) = 1.40667 = stdev