

CHOICE BOARD (SAMPLE RESPONSES)

1 point

Fair Dice:

$$P(2 \leq X < 5) = P(X = 2) + P(X = 3) + P(X = 4) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{1}{2} = 0.5$$

Eye Color:

	B	b
b	Bb	bb
b	Bb	bb

Brown eyes are represented by Bb. The probability of Bb is 50%.

Reflection:

Answers will vary.

2 Points

Baseball:

<i>S</i>	0	1	2	3	4	5	6	7	8
<i>P(S)</i>	$\frac{7}{162}$	$\frac{11}{162}$	$\frac{20}{162}$	$\frac{19}{162}$	$\frac{20}{162}$	$\frac{16}{162}$	$\frac{14}{162}$	$\frac{13}{162}$	$\frac{13}{162}$
<i>S</i>	9	10	11	12	13	14	15	16	
<i>P(S)</i>	$\frac{9}{162}$	$\frac{8}{162}$	$\frac{3}{162}$	$\frac{3}{162}$	$\frac{2}{162}$	$\frac{1}{162}$	$\frac{2}{162}$	$\frac{1}{162}$	

$$\begin{aligned} \mu_s = & 0 \cdot \frac{7}{162} + 1 \cdot \frac{11}{162} + 2 \cdot \frac{20}{162} + 3 \cdot \frac{19}{162} + 4 \cdot \frac{20}{162} + 5 \cdot \frac{16}{162} + 6 \cdot \frac{14}{162} + 7 \cdot \frac{13}{162} + 8 \cdot \frac{13}{162} + 9 \cdot \frac{9}{162} + \\ & 10 \cdot \frac{8}{162} + 11 \cdot \frac{3}{162} + 12 \cdot \frac{3}{162} + 13 \cdot \frac{2}{162} + 14 \cdot \frac{1}{162} + 15 \cdot \frac{2}{162} + 16 \cdot \frac{1}{162} = \frac{863}{162} = 5.327 \end{aligned}$$

The expected value is 5.327 points scored in a game.

Spinner Game:

X	\$0	\$5	-\$15
$P(X)$	$\frac{4}{10}$	$\frac{5}{10}$	$\frac{1}{10}$

$$\mu_x = 0 \cdot 0.4 + 5 \cdot 0.5 + (-15) \cdot 0.1 = 1$$

The fundraiser should expect to earn \$1 for each game played.

Actuaries:

Life insurance actuaries use random variables and P-tables to determine the premium for your policy. The premium is the amount of money an individual will pay per month or year for their family to receive a payout if they pass away during the policy time. Random variables that are used in this career include the policy amount and age of the client. There are P-tables that have been created based on death rates in the country that inform the actuary of the probability that an individual will pass away during the policy duration.

Healthcare actuaries also use random variables to determine the premium for the policy holder. In health insurance, there are group rates and individual rates. Group rates are when an entire company is covered by the policy regardless of the health of the employee. Random variables for group rates include the number of employees, the mean age of employees, and the number of claims in the company in the last year. When determining the premium for an individual rate, actuaries have more data for the person receiving the policy and can use age, gender, lifestyle (smoking, drinking, drug use), family medical history, personal medical history, and past claims to inform their decision.

Loan actuaries use random variables such as income, credit score, and assets to determine if they will give a customer their requested loan. These variables are used to help the actuary determine if the individual is a good risk for the company. The company only wants to give loans to an individual who will pay it back, so the probability of repayment of the loan is factored into the decision.

All actuaries mentioned are deciding whether to approve or deny the individual for their request. In some cases, individuals can be approved but for a higher payment or interest rate than their original request.

3 Points

Create Your Own:

Balloon pop: Consider a game where balloons are attached to a board in a 4 by 4 grid and the player throws the dart in hopes of popping the balloon. Each time a balloon pops, the game master replaces the balloon with another balloon of the same size. The dimensions of the board are 3 feet wide and 3 feet high, and the diameter of each balloon is 8 inches. It costs \$1 to play the game and if the player hits a balloon, they win \$3.

The probability of hitting a balloon each time is $1/16$ or 0.063 .

Music:

0 Cs	___	$6 \cdot 6 \cdot 6 = 216$
1 C	C__ or _C_ or __C	$6 \cdot 6 \cdot 3 = 108$
2 Cs	_CC or C_C or CC_	$6 \cdot 3 = 18$
3 Cs	CCC	1

The probability of at least 1 C in the chord is $\frac{108+18+1}{343} = \frac{127}{343} = 0.370$.

Let's Make a Deal:

Marilyn Vos Savant is an American columnist for Parade Magazine who went on to be listed in the Guinness book of World Records for having the world's highest IQ. In the mid-1980's Savant started her column "Ask Marilyn". She still writes for the column to this day. It was in her column that she answered the Monty Hall problem, and that was when the magazine began receiving thousands of letters, many from scholars and PhDs, informing her that she was incorrect and an idiot. Although Savant was correct, she was exposed to name-calling, gender bias, and persecution from the academic community. There was a whirlwind of interviews, articles, and academic journals written about Savant's decision, but Monty Hall himself set up a real-life simulation of the game in his dining room and invited anyone to come and play the game to back up Savant's theory. This simulation did prove Savant correct. However, he pointed out the game "Let's Make a Deal" is different from the original question because he could offer contestants money to not switch doors. Because of this alteration, Hall argued that a psychological component was added to the game show and threw all probability off.