Name _____

Class _____

Creating a Tree Diagram

Three basketball players are in a contest, hoping to win money for a charity. There is a 63% chance that Aisha will make a shot, a 74% chance that Bria will make a shot, and a 56% chance that Carmen will make a shot.

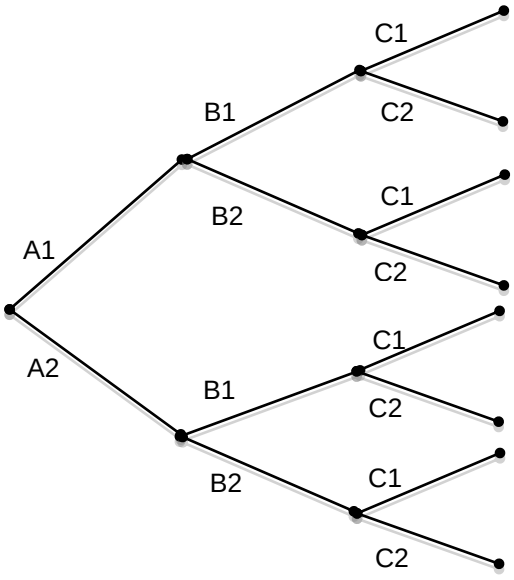
1. List the sample space for the three shots. Use an **A**, **B**, or **C** to represent each girl in the sample space.

2. What is the probability that **Aisha** will make her shot? Will miss her shot?

3. What is the probability that **Bria** will make her shot? Will miss her shot?

4. What is the probability that **Carmen** will make her shot? Will miss her shot?

One way to organize the results of the scenario is to create a diagram where each girl's shots are represented. Next to the labels of each branch write the appropriate probabilities. (A = Aisha, B = Bria, C = Carmen, 1 = made, 2 = miss.)



Since the events of each girl making her shot are independent, the **multiplication rule** for probability can be used. Use the diagram to help calculate the eight probabilities.

5. What is the probability that **none** of the girls make their shots?

6. What is the probability that **one** girl makes her shot? (*Hint:* Which of the eight probabilities must be added together to find the answer?)

7. What is the probability that **two** girls make their shots?

8. What is the probability that **all** the girls make their shots?

Introducing Expected Value

If only one of the players makes her shot, they earn $5,000. If two make shots, they earn $12,500. If all three are successful, they earn $20,000. All of the money earned goes to charity. What is the expected value of the contest for the charity?

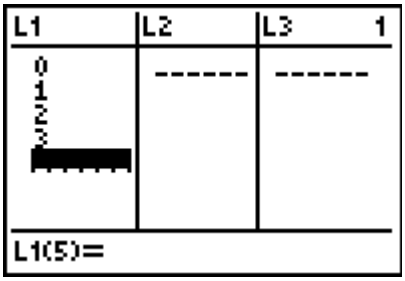
Press [STAT] [ENTER].

L1: Enter the possible outcomes (number of shots).

L2: Enter the probabilities from Questions 5 – 8.

L3: Enter the payoffs.

L4: Calculate **probabilities*payoff** by arrowing to the top of L4, typing **L2** [×] **L3**, and pressing [ENTER].



Expected Value is defined as the sum of the products of probabilities of the outcomes and their payoffs. Add the values in list L4 using the **sum** command to find the expected value of the contest. From the Home screen, press [2nd] [LIST] and arrow to the MATH menu. Select **sum(**, enter L4, and press [ENTER].

9. What is the expected value of the contest?

10. Should the charity expect this amount of money? Why or why not?

Extension – Putting it All Together

In a lottery game, players may pick six numbers from two separate pools of numbers — five different numbers from 1 to 56 and one number from 1 to 46. You win the jackpot by matching all six winning numbers in a drawing.

MATCH		MATCH	PRIZE	CHANCES
5	+	1	Jackpot	1 in 175,711,536
5	+	0	$250,000	1 in 3,904,701
4	+	1	$10,000	1 in 689,065
4	+	0	$150	1 in 15,313
3	+	1	$150	1 in 13,781
3	+	0	$7	1 in 306
2	+	1	$10	1 in 844
1	+	1	$3	1 in 141
0	+	1	$2	1 in 75
Overall chances of winning a prize:				1 in 40

1. Verify the chances to win the jackpot from your knowledge of counting principles.

2. Calculate the expected value for the lottery assuming the jackpot is $42 million.

3. Tickets cost $1.00 per play. How much does the lottery make/lose for each ticket sold?

4. What would the expected value need to be for the lottery to break even?

5. What would the jackpot need to be for the lottery to break even?