

*Names* \_\_\_\_\_

## *AP Stats –Probability Project A (2-way tables)*

<u>Criteria</u>	<u>Example</u>																																								
<p>1. Create a simple game with exactly 2 events</p> <p style="margin-left: 20px;">&gt; are the events independent or dependent?</p> <p>2. Construct possible outcomes and the probability for each using a two way table.</p>	<p>Event 1 - Pick Red or Black and draw a card from a standard deck with 2 jokers. Event 2 – Pick a number 1 to 6 and roll a die.</p> <p>The player can choose to pick for Event 1 only, Event 2 only, or both Event 1 and Event 2.</p> <p>Each die is independent.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th></th> <th style="text-align: center;">dice correct</th> <th style="text-align: center;">dice wrong</th> <th style="text-align: center;">total</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Red</td> <td style="text-align: center;"><math>26 \cdot 1 = 26</math></td> <td style="text-align: center;"><math>26 \cdot 5 = 130</math></td> <td style="text-align: center;">156</td> </tr> <tr> <td style="text-align: center;">Black</td> <td style="text-align: center;"><math>26 \cdot 1 = 26</math></td> <td style="text-align: center;"><math>26 \cdot 5 = 130</math></td> <td style="text-align: center;">156</td> </tr> <tr> <td style="text-align: center;">White (joker)</td> <td style="text-align: center;"><math>2 \cdot 1 = 2</math></td> <td style="text-align: center;"><math>2 \cdot 5 = 10</math></td> <td style="text-align: center;">12</td> </tr> <tr> <td style="text-align: center;">total</td> <td style="text-align: center;">54</td> <td style="text-align: center;">270</td> <td style="text-align: center;">324</td> </tr> </tbody> </table> <p>The above table show the number of outcomes that meet each scenario.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th></th> <th style="text-align: center;">dice correct</th> <th style="text-align: center;">dice wrong</th> <th style="text-align: center;">total</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Red</td> <td style="text-align: center;">0.080</td> <td style="text-align: center;">0.401</td> <td style="text-align: center;">0.481</td> </tr> <tr> <td style="text-align: center;">Black</td> <td style="text-align: center;">0.080</td> <td style="text-align: center;">0.401</td> <td style="text-align: center;">0.481</td> </tr> <tr> <td style="text-align: center;">White (joker)</td> <td style="text-align: center;">0.006</td> <td style="text-align: center;">0.031</td> <td style="text-align: center;">0.037</td> </tr> <tr> <td style="text-align: center;">total</td> <td style="text-align: center;">0.167</td> <td style="text-align: center;">0.833</td> <td style="text-align: center;">1.000</td> </tr> </tbody> </table> <p>The above table show the percent for each scenario.</p>		dice correct	dice wrong	total	Red	$26 \cdot 1 = 26$	$26 \cdot 5 = 130$	156	Black	$26 \cdot 1 = 26$	$26 \cdot 5 = 130$	156	White (joker)	$2 \cdot 1 = 2$	$2 \cdot 5 = 10$	12	total	54	270	324		dice correct	dice wrong	total	Red	0.080	0.401	0.481	Black	0.080	0.401	0.481	White (joker)	0.006	0.031	0.037	total	0.167	0.833	1.000
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<p>3. Decide on the payout for each type of game and calculate the expected outcomes.</p>	<p>Game type 1: pick the color will pay 1 to 1. Expected Outcome: <math>.481(1) + .519(-1) = -.038</math></p> <p>Game type 2: pick the number will pay 3 to 1 Expected Outcome: <math>.167(3) + .833(-1) = -.333</math></p> <p>Game type 3: pick the color and the number will pay 10 to 1 Expected Outcome: <math>.08(10) + .92(-1) = -.12</math></p>																																								
<p>4. Create a Game Board/Table that attracts players to your table and explains your game in simple language. You must include</p> <ul style="list-style-type: none"> <li>○ A description of the rules</li> <li>○ A description of the possible outcomes</li> <li>○ The payout for each outcome</li> <li>○ The probability for each outcome as a percent</li> <li>○ The overall expected outcome for the game</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th colspan="2" style="text-align: center;">Place Your Token</th> <th colspan="2" style="text-align: center;">pays 1 to 1</th> </tr> <tr> <th colspan="2" style="text-align: center;">Three ways to win!</th> <th style="text-align: center;">Red</th> <th style="text-align: center;">Black</th> </tr> </thead> <tbody> <tr> <td rowspan="6" style="text-align: center; vertical-align: middle;">pays 3 to 1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1 &amp; Red</td> <td style="text-align: center;">1 &amp; Black</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">2 &amp; Red</td> <td style="text-align: center;">2 &amp; Black</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">3 &amp; Red</td> <td style="text-align: center;">3 &amp; Black</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">4 &amp; Red</td> <td style="text-align: center;">4 &amp; Black</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">5 &amp; Red</td> <td style="text-align: center;">5 &amp; Black</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">6 &amp; Red</td> <td style="text-align: center;">6 &amp; Black</td> </tr> <tr> <td colspan="2" style="text-align: center;">Place your token!</td> <td colspan="2" style="text-align: center;">pays 8 to 1</td> </tr> </tbody> </table>	Place Your Token		pays 1 to 1		Three ways to win!		Red	Black	pays 3 to 1	1	1 & Red	1 & Black	2	2 & Red	2 & Black	3	3 & Red	3 & Black	4	4 & Red	4 & Black	5	5 & Red	5 & Black	6	6 & Red	6 & Black	Place your token!		pays 8 to 1										
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## *AP Stats –Probability Project B (tree diagrams)*

### Criteria

1. Create a simple game with at least 2 events

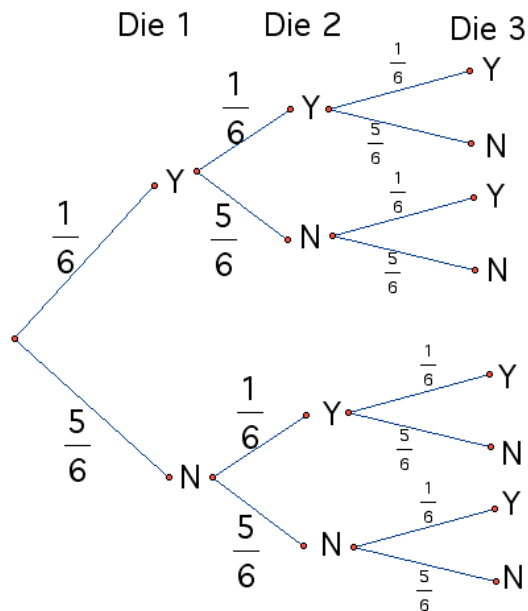
> are the events independent or dependent?

2. Construct possible outcomes and the probability for each using a tree diagram.

### Example

Pick a number from 1 to 6. Roll 3 dice. The more your number showed up, the better your prize.

Each die is independent.



### Possible Outcomes

The number selected can show up 0, 1, 2, or 3 times.

$$P(3 \text{ times}) = (1/6)(1/6)(1/6) = 1/216 \quad (.005)$$

$$P(2 \text{ times}) = 3(1/6)(1/6)(5/6) = 15/216 \quad (.069)$$

$$P(1 \text{ time}) = 3(1/6)(5/6)(5/6) = 75/216 \quad (.347)$$

$$P(0 \text{ times}) = (5/6)(5/6)(5/6) = 125/216 \quad (.579)$$

The Sum should be 1  $.005 + .069 + .347 + .579 = 1$

Criteria	Example
<p>3. Figure out how much the player will win when they bet one token. Use your payouts to calculate the overall expected outcome per token played. Modify your payouts until you have a game that is attractive to potential players, but still gives you (the dealer) the long-term advantage.</p> <p>Remember, the closer the expected value is to 0 the more fair the game. If the expected value is positive, the odds are in the favor of the player. If the expected value is negative, the odds are in the favor of the house.</p>	<p><u>My first attempt at creating the payouts:</u>  Player bets 1 token and picks a number.  4 possible outcomes  # hits 0 times = -1 (I keep the token)  # hits 1 time = 0 (I return token)  # hits 2 times = 1 (I return token and pay 1 token)  # hits 3 times = 2 (I return token and pay 2 tokens)</p> <p>Expected Return for player:  <math>-1(125/216) + 0(75/216) + 1(15/216) + 2(1/216) = -108/216</math> or <math>-.5</math>  This heavily favors the house</p> <p><u>My second attempt at creating the payouts:</u>  Player bets 1 token and picks a number.  4 possible outcomes  # hits 0 times = -1 (I keep the token)  # hits 1 time = 1 (I return token)  # hits 2 times = 2 (I return token and pay 1 token)  # hits 3 times = 3 (I return token and pay 2 tokens)</p> <p>New Expected Return for player:  <math>-1(125/216) + 1(75/216) + 2(15/216) + 3(1/216) = -17/216</math> or <math>-.079</math> This slightly favors the house.</p>
<p>4. Create a Game Board/Table that attracts players to your table and explains your game in simple language. You must include</p> <ul style="list-style-type: none"> <li>○ A description of the rules</li> <li>○ A description of the possible outcomes</li> <li>○ The payout for each outcome</li> <li>○ The probability for each outcome as a percent</li> <li>○ The overall expected outcome for the game</li> </ul>	<p><b><u>How You Are Graded:</u></b>  20% creation of game  20% tree diagram and percentages  20% payouts and expected outcome  20% game board/table  20% participation in the casino</p>

**You will hand this sheet to me with 4 signatures from me for the 4 parts described above.**