Finding Probability of a Binomial Event (Win/Lose)

WARM UP: Jake has set up a ring toss game. He plans on letting players toss 3

1. How many outcomes are there? List them all out. 8

HHH HMH MHH MMH
HHM HMM MHM MMM

2. What is the probability that someone makes all three tosses?

1/8

3. What is the probability that someone makes two tosses?

3/8

4. What is the probability that someone makes no tosses? How does that compare to your answer to question 2? Why do you think so?

1/8

At the National Baseball Batting Contest, the organizers have set up game booths for the contestants. In the game you will be pitched 5 fastballs and you must hit them into a fair zone to win. The game costs $3 to play. The prizes are as follows

- Hit all 5 pitches, you win a large stuffed animal
- Hit 3 or 4 pitches, you win a small stuffed animal

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- Hit all 5 pitches, you win a large stuffed animal
- Hit 3 or 4 pitches, you win a small stuffed animal
- Hit 1 or 2 pitches, you win a bat-shaped pencil
- Hit no pitches and you do not win a prize

THEORETICAL PROBABILITY

5. What is the probability of getting each of the following. Leave answers as *unsimplified* fraction (you will see why later)

32 OUTCOMES

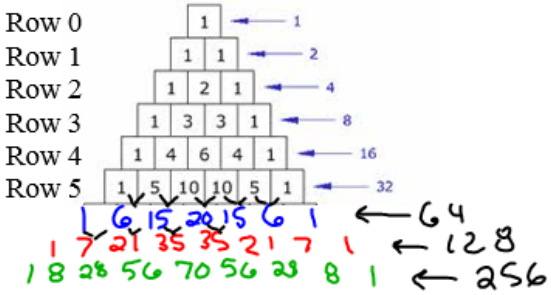
5 pitches	4 pitches	3 pitches	2 pitches	1 pitch	No pitches
$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

6. The people who run the game are expecting 160 people to play. If 160 people play how many people can they expect to make the following?

5 pitches	4 pitches	3 pitches	2 pitches	1 pitch	No pitches
$160(\frac{1}{32})$ 5	$160(\frac{5}{32})$ 25	$160(\frac{10}{32})$ 50	$160(\frac{10}{32})$ 50	$160(\frac{5}{32})$ 25	$160(\frac{1}{32})$ 5

PASCAL's TRIANGLE:

What if the game was not 5 pitches but 10 pitches? Would you want to draw a tree diagram to find all the total outcomes? Probably not. Pascal's triangle is a way to find all the probabilities of a binomial event. A **binomial event** is something where there are only 2 outcomes which in this case is hit, miss. Other binomial events could be right/wrong or win/lose.



$\frac{1}{32}$ $\frac{5}{32}$ $\frac{10}{32}$ $\frac{10}{32}$ $\frac{5}{32}$ $\frac{1}{32}$

10. Look at Pascal's triangle above. Each row in the triangle is formed from the one above. Discover the pattern used to create each row.

START EACH ROW WITH 1. ADD THE TWO NUMBERS ABOVE IT. END EACH ROW WITH 1

11. Off to the right hand side is a number. How does that number relate to the number in that row?

IT IS THE SUM OF ALL NUMBERS IN THE ROW

12. Look back to your answers for question 5. How do your answers compare to row 5 of Pascal's triangle?

THE NUMERATORS ARE THE NUMBERS FROM THE 5TH ROW AND THE DENOMINATOR IS THE SUM TOTAL OF ALL THE #S

13. Use the pattern to create out to row 8.

7. Again assuming that 160 people play the game how many of the following prizes can the workers expect to have to give away?

ALL 5 | 3 or 4 | 1 or 2

Large Stuffed Animal	Small Stuffed Animal	Bat Pencil
5	75	75

8. The people who run the game know that a large stuffed animal will cost them $6, a small stuffed animal will cost them $1 and a bat pencil costs them $0.25. Assuming 160 people play the game how much money should they expect to spend in prize expenses? Show work or explain how you arrived at this answer.

$6 × 5 + $1 × 75 + $.25 × 75
30 + 75 + 18.75 = $123.75

9. How much profit should the workers expect if 160 people play the game? (remember that is costs $3 to play the game). Show work or explain how you arrived at this answer.

$3 × 160 = $480
− 123.75
$356.25

EXPECTED VALUE OF 1 PLAY

$ • PROB

$6(1/32) + $1(5/32) + $1(10/32) + $.25(10/32) + $.25(5/32) + 0(1/32)

.19 + .16 + .31 + .08 + .04 + 0 = $.78

- IF WE CHARGE $3 TO PLAY $3 − .78 = IS AN EXPECTED PROFIT OF $2.22 PER PLAYER
- IF 160 PLAY THEN 160 × 2.22 = $355.20