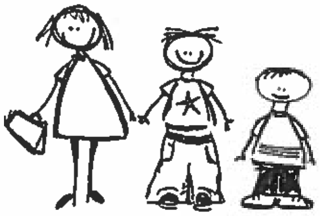
Name: ______________________________ Hour: _____ Date: _____

Lesson 6.1: Day 1: How many children are in your family?




Count up the number of children in your family (including yourself). Be sure to include all your stepbrothers/stepsisters and half-brothers/half-sisters.

Let X = the number of children. Suppose we choose someone from the class at random.

X	1	2	3	4	5	6+
Probability						

1. Is this a valid probability model? Explain.

2. Is 5.7167 a possible value for X? Explain.

3. Make a histogram to display information with X on the horizontal axis, and describe its shape.

4. Describe in words what $P(X \geq 3)$ and then find $P(X \geq 3)$.

5. Describe in words what $P(X > 3)$ and then find $P(X > 3)$.

6. Find the average of the X values.

7. Does this value tell us the average number of children in the families of students in this class? If yes, explain. If no, why not?

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.1 Day 1– Discrete Random Variables

Important ideas:

Check Your Understanding

Indiana University Bloomington posts the grade distributions for its courses online. Suppose we choose a student at random from a recent semester of this university's Business Statistics course. The student's grade on a 4-point scale (with A = 4) is a random variable *X* with this probability distribution:

Value	0	1	2	3	4
Probability	0.011	0.032	???	0.362	0.457

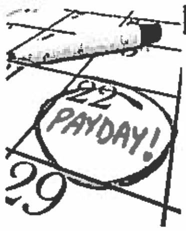
1. Write the event "the student got a C" using probability notation. Then find this probability.

2. Explain in words what $P(X \geq 3)$ means. What is this probability?

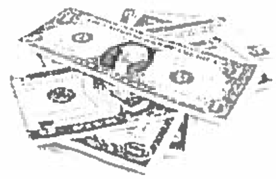
3. Make a histogram of the probability distribution. Describe its shape.

4. Calculate and interpret the expected value of *X*.

Name: ______________________ Hour: _____ Date: _____



Lesson 6.1: Day 2: How much do you get paid?



Suppose you got a new job and each day your boss (Mrs. Gallas) draws a slip of paper from a bag to determine your wage for the day. Let the random variable *X* = daily wage ($ per hour).

1. What is your wage for the day? ________ Add your data to the table on the board and complete the table below.

X	1	5	7	10	15	25
Probability						

2. Calculate and interpret the expected value of *X*.

3. Recall from chapter 1 that standard deviation tells us the typical distance from the mean. Complete the table to calculate the standard deviation for the probability distribution.

4. Interpret the standard deviation.

5. Mrs. Gallas decides she would rather assign wages so that employees could get any amount from $10 to $20 and all are equally likely. Draw a graph to represent this probability distribution.

Value	Distance from mean	$(\text{Distance from mean})^2$	Weighted $(\text{Distance from the mean})^2$
1			
5			
7			
10			
15			
25			
		Total =	
		SD =	

6. What is the probability that an employee makes between $12 and $12.50?

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.1 Day 2– Probability and Continuous Random Variables

Important ideas:

Check Your Understanding

The heights of young women can be modeled by a Normal distribution with mean $\mu = 64$ inches and standard deviation $\sigma = 2.7$ inches. Suppose we choose a young woman at random and let Y = her height (in inches).

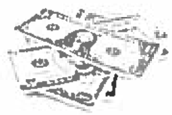
1. What type of variable is Y, discrete or continuous? Explain.

2. Interpret the standard deviation.

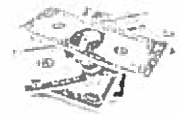
3. Find $P(Y \leq 63)$. Interpret this value.

4. Find $P(68 \leq Y \leq 70)$. Interpret this value.

Name: ______________________________ Hour: _____ Date: ______



Lesson 6.2: Day 1: Time for a Raise



Mrs. Gallas' employees have been working very hard and it's time she gives them a raise. She is trying to decide if she should give everyone a $10 raise (add $10 per hour) or double everyone's wage (multiply by 2).

1. Copy the data collected from yesterday's lesson below.

X	1	5	7	10	15	25
Probability						

Mean: __________ Standard Deviation: __________

2. To make a decision about what raise should be given, complete the tables below and calculate the new mean and standard deviation using your calculator.

a. Option 1: Add $10 per hour to all employees

X – Old Wage	1	5	7	10	15	25
Y - New Wage						
Probability						

Mean: __________ Standard Deviation: __________

How did adding a constant affect the mean and standard deviation?

b. Option 2: Double the wage of all employees

X – Old Wage	1	5	7	10	15	25
Z - New Wage						
Probability						

Mean: __________ Standard Deviation: __________

How did multiplying by a constant affect the mean and standard deviation?

3. Which option would you prefer? Why?

Name: ________________________ Hour: _____ Date: _____

Lesson 6.2 Day 1– Transforming Probability Distributions

Important ideas:

Check Your Understanding

A large auto dealership keeps track of sales made during each hour of the day. Let X = the number of cars sold during the first hour of business on a randomly selected Friday. Based on previous records, the probability distribution of X is as follows:

Cars sold	0	1	2	3
Probability	0.3	0.4	0.2	0.1

The random variable X has mean $\mu_x = 1.1$ and standard deviation $\sigma_x = 0.943$. Suppose the dealership's manager receives a $500 bonus from the company for each car sold. Let Y = the bonus received from car sales during the first hour on a randomly selected Friday.

1. Sketch a graph of the probability distribution of X and a separate graph of the probability distribution of Y. How do their shapes compare?

2. Find the mean of Y.

3. Calculate and interpret the standard deviation of Y.

4. The manager spends $75 to provide coffee and doughnuts to prospective customers each morning. So the manager's net profit T during the first hour on a randomly selected Friday is $75 less than the bonus earned. Describe the shape, center, and variability of the probability distribution of T.

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.2: Day 2: How much will you make next year?

After much thought Mrs. Gallas has finally decided on permanent employee wages which are randomly assigned using the probability distribution *X* given below. Additionally, at the end of every year she gives her employees an hourly raise. The bonuses are assigned randomly according to the probability distribution *Y* given below. Assume *X* and *Y* are independent.

1. Find the mean, variance and standard deviation of the probability distribution of *X*, the hourly wages.

X	9	12	15
Probability	0.30	0.45	0.25

Mean: ________ Variance: ________ Standard Deviation: ________

2. Find the mean, variance and standard deviation of the probability distribution of *Y*, the annual hourly raise.

Y	$1	$3
Probability	0.70	0.30

Mean: ________ Variance: ________ Standard Deviation: ________

3. Let *N* = the new hourly wage for the upcoming year (*X* + *Y*).

a. What are all the possible new hourly wages for the new year?

b. What is the probability of an employee being assigned a $9 wage **AND** a $1 raise? Show your work.

c. Complete the table below for the probability distribution of *N* = *X* + *Y* and find the mean and standard deviation.

N						
Probability						

Mean: ________ Variance: ________ Standard Deviation: ________

d. If *N* = *X* + *Y*, complete the following in terms of *X* and *Y*:

$\mu_N =$ $\sigma_N =$

Name: ______________________ Hour: _____ Date: ______

Lesson 6.2 Day 2– Combining Probability Distributions

Important ideas:

Check Your Understanding

A large auto dealership keeps track of sales and lease agreements made during each hour of the day. Let *X* = the number of cars sold and *Y* = the number of cars leased during the first hour of business on a randomly selected Friday. Based on previous records, the probability distributions of *X* and *Y* are as follows:

Cars sold x_i	0	1	2	3
Probability p_i	0.3	0.4	0.2	0.1

Mean: $\mu_X = 1.1$ Standard deviation: $\sigma_X = 0.943$

Cars leased y_i	0	1	2
Probability p_i	0.4	0.5	0.1

Mean: $\mu_Y = 0.7$ Standard deviation: $\sigma_Y = 0.64$

Define $T = X + Y$. Assume that *X* and *Y* are independent.

1. Find and interpret μ_T.

2. Calculate and interpret σ_T.

3. The dealership's manager receives a \$500 bonus for each car sold and a \$300 bonus for each car leased. Find the mean and standard deviation of the manager's total bonus *B*.

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3: Day 1: Is it smart to foul at the end of the game?

In the 2005 Conference USA basketball tournament, Memphis trailed Louisville by two points. At the buzzer, Memphis's Darius Washington attempted a 3-pointer; he missed but was fouled, and went to the line for three free throws. Each made free throw is worth 1 point. Was it smart to foul?

1. What are all the possible ways the shots could fall (e.g. make-miss-miss, etc.)?

2. Darius Washington was a 72% free-throw shooter. Find the probability that Memphis will win, lose or go to overtime. When you have found the probabilities put them in the table in #3.

Win	Lose	Overtime

3. Prior to watching each shot, calculate the probability that Memphis wins the game in regulation, loses the game in regulation, or sends the game into overtime.

		Shots Remain.	Probability Memphis Win	Probability Memphis Lose	Probability Overtime
75	73				
75					
75					

4. Washington is a 40% 3-point shooter. Do you think Louisville was smart to foul? Why or why not?

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3 Day 1– Binomial Random Variables

Important ideas:

Check Your Understanding

1. For each of the following situations, determine whether or not the given random variable has a binomial distribution. Justify your answer.

a. Shuffle a deck of cards. Turn over the top card. Put the card back in the deck, and shuffle again. Repeat this process 10 times. Let X = the number of aces you observe.

b. Choose 5 students at random from your class. Let Y = the number who are over 6 feet tall.

2. Pedro drives the same route to work on Monday through Friday. His route includes one traffic light. According to the local traffic department, there is a 55% chance that the light will be red on a randomly selected work day. Suppose we choose 10 of Pedro's work days at random and let Y = the number of times that the light is red.

a. Explain why Y is a binomial random variable.

b. Find the probability that the light is red on exactly 7 days.

Name: ______________________ Hour: _____ Date: ______

Lesson 6.3: Day 2: Will the EKHS girls' soccer team win?



When the time runs out in a soccer game and the score is tied, the game will go to a shootout. Each team gets to choose 5 players to kick penalty kicks. Whichever team makes the most penalty kicks wins. If the EKHS girls' soccer team makes 60% of their penalty kicks, what are the chances they will win the game?

1. Is this a binomial setting? Explain.

2. Fill in the table below showing the probability of making X penalty kicks.

Goals (X)	0	1	2	3	4	5
Probability						

3. Find and interpret the mean of the probability distribution. Show your work.

4. Find and interpret the standard deviation of the distribution.

5. What is the probability that the team scores at least one goal?

6. If the other team is expected to make 3 goals, what is the probability that the EKHS girls' team wins?

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3 Day 2– Describing Binomial Distributions

Important ideas:

Check Your Understanding

Mr. Miller's class is very difficult. It's so hard that when he gave a pop quiz recently, the students just guessed on every question! Each student in the class guesses an answer from A through E on each of the 10 multiple-choice questions. Hannah is one of the students in this class. Let Y = the number of questions that Hannah answers correctly.

1. Does this setting represent a binomial distribution? Explain.

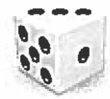
2. Use technology to make a histogram of the probability distribution of Y. Describe its shape.

3. Calculate and interpret the mean of Y.

4. Calculate and interpret the standard deviation of Y.

Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3: Day 4: GREED



We're going to play Greed. Each round you must decide if you want to sit or stand. If you sit, you keep all earned points but are no longer playing. If you stand, you must play the round. You earn 1 point for each round you make it through. Mrs. Gallas is going to roll a die. If the die lands on a number from 1 to 5, the people standing move on to the next round. If the die lands on a 6 the people standing lose all their points.

1. How many points did you earn?

2. Let X = the number of rounds played until a 6 occurs. Is this a binomial setting? Explain.

3. Use probability rules to calculate the probability for each of the following. Show work.

   a. $P(X = 1)$

   b. $P(X = 2)$

   c. $P(X = 3)$

   d. $P(X = 4)$

   e. $P(X = k)$

4. Write the probability that a 6 is rolled within the first 4 rolls in terms of X and find the probability. Show your work.

5. How many rolls would you **predict** it to take until a 6 is rolled? Why?

6. What shape would the distribution of X have? Explain.

Name: ______________________ Hour: _____ Date: _____

Lesson 6.3 Day 4 – Geometric Distributions

Important ideas:

Check Your Understanding

Marti decides to keep placing a $1 bet on number 15 in consecutive spins of a roulette wheel until she wins. On any spin, there's a 1-in-38 chance that the ball will land in the 15 slot. Let *T* = the number of spins it takes until Marti wins.

1. Show that T is a geometric random variable.

2. Find P(T = 3). Interpret this result.

3. How many spins do you expect it to take for Marti to win?

4. Would you be surprised if Marti won in 3 or fewer spins? Compute an appropriate probability to support your answer.

AP Statistics   Name________________________

Rules for Means and Variances

Assume X and Y are independent random variables.

1. Find the mean, variance, and standard deviation of X. (stat, calc, 1-var stat L1,L2)

X	-1	0	1	2
p	0.3	0.1	0.5	0.1

2. Find the mean, variance, and standard deviation of Y.

Y	2	3	5
p	0.6	0.3	0.1

3. a. Let W = 3 + 2 X. Find the mean, variance, and standard deviation of W using the rules.

b. Construct W and find the mean, variance, and standard deviation of W using 1-var stat.

W				
p				

4. a. Let W = X + Y. Find the mean, variance, and standard deviation of W using the rules.

b. Construct W and find the mean, variance, and standard deviation of W using 1-var stat. (Be careful: There are 12 different sums. Use the product of the probabilities.)

W												
p												

5. a. Let W = X - Y. Find the mean, variance, and standard deviation of W using the rules.

b. Construct W and find the mean, variance, and standard deviation of W using 1-var stat.

W												
p												

6. a. Let W = X + X. Find the mean, variance, and standard deviation of W using the rules.

b. Construct W and find the mean, variance, and standard deviation of W using 1-var stat.

W																
p																

7. a. Let W = 2X. Find the mean, variance, and standard deviation of W using the rules.

b. Construct W and find the mean, variance, and standard deviation of W using 1-var stat.

W				
p				

Finding the Cherry Starbursts

A bag of Starburst candies can be considered an SRS of the whole population of Starburst candies. Since there are 4 flavors, the probability that each Starburst is cherry flavor is ¼ = 0.25. Each bag of Starburst contains 200 candies. Suppose we buy one bag of Starburst.

X → the number of cherry flavor Starburst candies in the bag

1. Is this a binomial distribution?

2. What is n?__________ What is p?_______

3. What is the mean of X?_________ Interpret:

4. What is the standard deviation of X?____________ Interpret:

5. What is the probability of getting exactly 60 cherry flavored starburst?

6. What is the probability of getting at most 60 cherry flavored starburst

Normal Approximation to the Binomial

Redo problem #6 above with a normal distribution. To do this $np \geq 10$ and $n(1-p) \geq 10$.

TheStatsMedic

AP Statistics Activity Wrap-up

Name______________

Activity Name:

Describe the activity or context:	
What important statistical concepts did we learn?	

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