1) In October 1966, the United States Congress passed the Endangered Species Preservation Act. Subsequent legislation and international conventions are part of a worldwide effort to save endangered and threatened species. The U.S. Fish and Wildlife Service works to protect and recover these species and maintains data on endangered and threatened species. Between 1989 and 2008, 34 species were removed from the list of endangered or threatened species. Reasons for removal from the list include recovery, inaccurate original data and extinction. In this twenty year period, only three species have been removed due to extinction. (*source: U.S. Fish and Wildlife Service*)

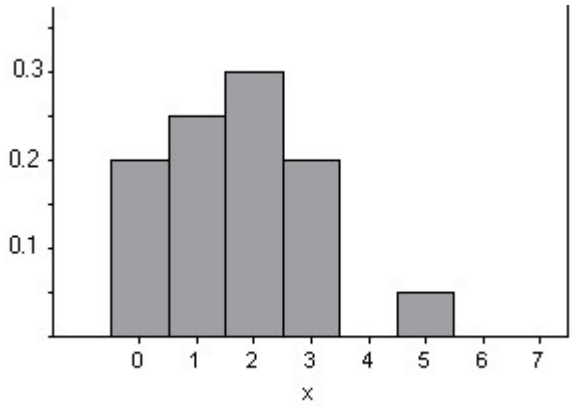
# of species removed from list	0	1	2	3	4	5
# of years in which that # of species was removed from the list.	4	5	6	4	0	1

That means that in 6 different years, 2 species were removed from the list. Note that the sum of the second row is 20 – the number of years for this study.

a) Construct the probability distribution of this data.

# of species removed from list	*0*	*1*	*2*	*3*	*4*	*5*
probability	$\frac{4}{20}=0.2$	$\frac{5}{20}=0.25$	$\frac{6}{20}=0.3$	$\frac{4}{20}=0.2$	$\frac{0}{20}=0$	$\frac{1}{20}=0.05$

b) Construct the probability histogram for this data.



c) Determine the mean of the probability distribution.

$$\mu = 0(0.2)+1(0.25)+2(0.3)+3(0.2)+4(0)+5(0.05)=1.7$$

d) Based on the data, how many species can the U.S. Fish and Wildlife Service expect to remove from the list per year? *1.7*

2) A hurricane is a tropical cyclone with wind speeds that have reached at least 74 mph. Hurricanes are classified using the Saffir-Simpson scale, ranging from Category 1 to Category 5. Category 3 to 5 hurricanes are considered "major hurricanes." The table below lists the number of major hurricanes in the Atlantic Basin by year. *(source: National Climatic Data Center)*

Year	# of major hurricanes
1984	1
1985	3
1986	0
1987	1
1988	3
1989	2
1990	1
1991	2
1992	1

Year	# of major hurricanes
1993	1
1994	0
1995	5
1996	6
1997	1
1998	3
1999	5
2000	3

Year	# of major hurricanes
2001	4
2002	2
2003	3
2004	6
2005	7
2006	2
2007	2
2008	5

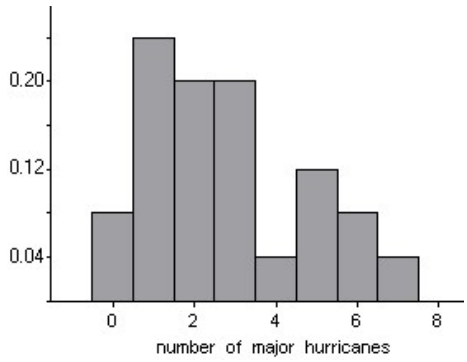
a) Construct a frequency table for this data.

# of major hurricanes, X	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
frequency	*2*	*6*	*5*	*5*	*1*	*3*	*2*	*1*

b) Construct the probability distribution for this data.

# of major hurricanes, X	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
P(X)	*0.08*	*0.24*	*0.2*	*0.2*	*0.04*	*0.12*	*0.08*	*0.04*

c) Construct a probability histogram for this data.



c) Determine the mean of the probability distribution.

$$\mu = 0(0.08) + 1(0.24) + 3(0.2) + 4(0.04) + 5(0.12) + 6(0.08) + 7(0.04) = 2.77$$

d) Based on the data, how many hurricanes can be expected in the Atlantic Basin in a year? *2.77*

3) The first Olympic Winter Games were held in 1924. Between 1924 and 2006, twenty Winter Olympics have been held. The Winter Games were suspended in 1940 and 1944 due to World War II. The United States has participated in all twenty Olympic Winter Games. *(source: International Olympic Committee, http://www.olympics.org)*

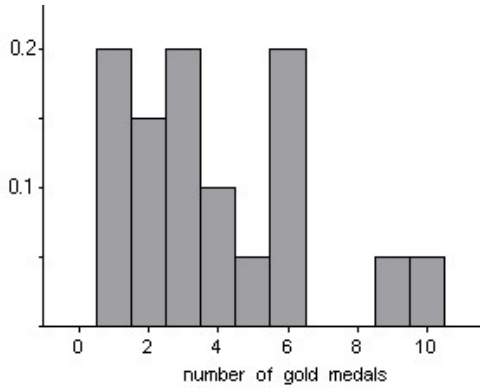
Year	Gold Medals	Silver Medals	Bronze Medals
2006	9	9	7
2002	10	13	11
1998	6	3	4
1994	6	5	2
1992	5	4	2
1988	2	1	3
1984	4	4	0
1980	6	4	2
1976	3	3	4
1972	3	2	3
1968	1	5	4

1964	1	2	3
1960	3	4	3
1956	2	3	2
1952	4	6	1
1948	3	4	2
1936	1	0	3
1932	6	4	2
1928	2	2	2
1924	1	2	1

a) Construct the discrete probability distribution for the number of gold medals.

# of Gold Metals, x	1	2	3	4	5	6	7	8	9	10
P(x)	***0.2***	***0.15***	***0.2***	***0.1***	***0.05***	***0.2***	***0***	***0***	***0.05***	***0.05***

b) Construct the probability histogram of this distribution.



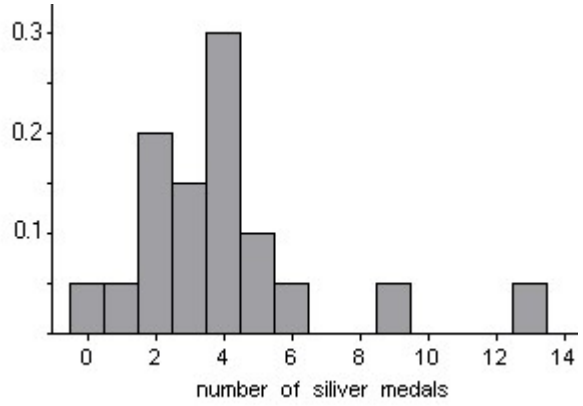
c) How many gold medals can the U.S. expect to win based on the given data?

$$\mu_{gold} = 1(0.2) + 2(0.15) + 3(0.2) + 4(0.1) + 5(0.05)$$
$$+ 6(0.2) + 9(0.05) + 10(0.05) = 3.9$$

d) Construct the probability distribution for the number of silver medals won.

# of Silver Metals, x	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*9*	*13*
P(x)	*0.05*	*0.05*	*0.2*	*0.15*	*0.3*	*0.1*	*0.05*	*0.05*	*0.05*

e) Construct the probability histogram for this distribution.



f) How many silver medals can the U.S. expect to win per Olympics based on the given data?

$$\mu_{silver} = 0(0.05)+1(0.05)+2(0.2)+3(0.15)+4(0.3)+5(0.1)$$
$$+6(0.05)+9(0.05)+13(0.05)=4$$

4. Let's explore the probabilities associated with tossing a coin, focusing on the number of heads in four tosses of one coin. The theoretical probability distribution for this situation is below.

Number of heads, X	0	1	2	3	4
P(X)	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{16}$

a) Will experimental results match this theoretical distribution? Collect your own data by completing 32 trials. Compare the distribution of your data to the theoretical distribution.

Answers will vary. Make sure that students are completing 32 trials of 4 tosses and do not count each individual toss as a trial.

b) Combine the data from your entire class into one probability distribution.

Answers will vary. The easiest way to accomplish combining the data from all groups in the class is to create a large frequency table on your board and then have the class, or each group, create the probability distribution for the class.

c) How does this distribution compare to your group's distribution?

Answers will vary

d) How does this distribution compare to the theoretical distribution?

Answers will vary

Please Be Discrete Learning Task

Name _____ Date_____

MGSE9-12.S.MD.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

MGSE9-12.S.MD.2 Calculate the expected value of a random variable; interpret it as the mean of a probability distribution.

MGSE9-12.S.MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; fin the expected value

MGSE9-12.S.MD.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Model with mathematics
4. Attend to precision

1) In October 1966, the United States Congress passed the Endangered Species Preservation Act. Subsequent legislation and international conventions are part of a worldwide effort to save endangered and threatened species. The U.S. Fish and Wildlife Service works to protect and recover these species and maintains data on endangered and threatened species. Between 1989 and 2008, 34 species were removed from the list of endangered or threatened species. Reasons for removal from the list include recovery, inaccurate original data and extinction. In this twenty year period, only three species have been removed due to extinction. (*source: U.S. Fish and Wildlife Service*)

# of species removed from list	0	1	2	3	4	5
# of years in which that # of species was removed from the list.	4	5	6	4	0	1

a) Construct the probability distribution of this data.

b) Construct the probability histogram for this data on your graph paper.

c) Determine the mean of the probability distribution.

d) Based on the data, how many species can the U.S. Fish and Wildlife Service expect to remove from the list per year?

2) A hurricane is a tropical cyclone with wind speeds that have reached at least 74 mph. Hurricanes are classified using the Saffir-Simpson scale, ranging from Category 1 to Category 5. Category 3 to 5 hurricanes are considered "major hurricanes." The table below lists the number of major hurricanes in the Atlantic Basin by year. *(source: National Climatic Data Center)*

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Year	# of major hurricanes
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1999	5
2000	3

Year	# of major hurricanes
2001	4
2002	2
2003	3
2004	6
2005	7
2006	2
2007	2
2008	5

a) Construct a frequency table for this data.

b) Construct the probability distribution for this data.

c) Construct a probability histogram for this data on your graph paper.

d) Determine the mean of the probability distribution.

e) Based on the data, how many hurricanes can be expected in the Atlantic Basin in a year?

3) The first Olympic Winter Games were held in 1924. Between 1924 and 2006, twenty Winter Olympics have been held. The Winter Games were suspended in 1940 and 1944 due to World War II. The United States has participated in all twenty Olympic Winter Games. *(source: International Olympic Committee, http://www.olympics.org)*

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1972	3	2	3
1968	1	5	4
1964	1	2	3
1960	3	4	3
1956	2	3	2
1952	4	6	1
1948	3	4	2
1936	1	0	3
1932	6	4	2
1928	2	2	2
1924	1	2	1

a) Construct the discrete probability distribution for the number of gold medals.

# of Gold Metals, x										
P(x)										

b) Construct the probability histogram of this distribution on your graph paper.

c) How many gold medals can the U.S. expect to win per Olympics based on the given data?

d) Construct the probability distribution for the number of silver medals won.

# of Silver Metals, x									
P(x)									

e) Construct the probability histogram for this distribution on your graph paper.

f) How many silver medals can the U.S. expect to win per Olympics based on the given data?

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