2.7 – Probability Distributions with Discrete Random Variables

– **discrete random variable** → a variable whose value is the numerical outcome of a random event.

– **probability distribution** → a function that maps the sample space to the probabilities of the outcomes in the sample space which can be visually represented by a histogram.

f(x) = (equation) → data → graph

Examples: Complete each problem appropriately.

1.) The table shows the distribution of the number of heads when 4 coins are tossed.

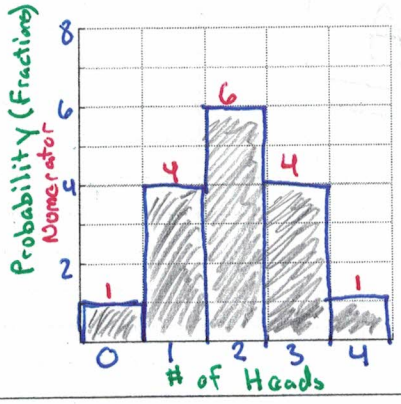
"x"

H = Heads	0	1	2	3	4
"y" Probability	1/16	1/4	3/8	1/4	1/16
		4/16	6/16	4/16	

* Tossed the 4 coins a total of 16 times!

$\frac{1}{16} + \frac{4}{16} + \frac{6}{16} + \frac{4}{16} + \frac{1}{16} = \frac{16}{16} = 1$ or 100%

a.) Create a probability histogram.



b.) What is the probability of getting three heads?

$\frac{1}{4} \rightarrow \frac{4}{16} =$ 25%

c.) What is the probability of getting at least two heads?

$\frac{6}{16} + \frac{4}{16} + \frac{1}{16} = \frac{11}{16} \rightarrow$ 68.8%

d.) What is the probability of getting no more then one head?

$\frac{1}{16} + \frac{4}{16} = \frac{5}{16} \rightarrow$ 31.3%

2.) The instructor of a large class gives 15% of A's and D's, 30% of B's and C's, and 10% of F's. Let x be the random variable assigned to a student's grade on a 4-point scale, where A = 4, B = 3, etc.

a.) Create a probability table that models the information above.

x = student's grade	A 4	B 3	C 2	D 1	F 0
Probability	.15	.30	.30	.15	.10

← 1 or 100%

b.) If a student is selected at random from this class, what grade would we expect them to have?

4(.15) + 3(.30) + 2(.30) + 1(.15) + 0(.10) = 2.25 Low C

c.) What percent of the class is passing?

.15 + .30 + .30 + .15 = .9 → 90%

d.) What percent of the class has a B or better?

.15 + .30 = .45 → 45%

3.) The table shows the probabilities for the number of people who live in a typical U.S. household.

x = number of occupants	1	2	3	4	5	6	7
Probability	0.25	0.32	.17	0.15	0.07	0.03	0.01

= 1

a.) What is the probability of people in the U.S. leaving in a household with 3 occupants?

.25 + .32 + .15 + .07 + .03 + .01 = .83 → 1 − .83 = .17

b.) If a random U. S household is selected, how many occupants would we expect to find leaving there?

1(.25) + 2(.32) + 3(.17) + 4(.15) + 5(.07) + 6(.03) + 7(.01) = 2.76 occupants

c.) What percent of U.S. households have at least 5 people living there?

.07 + .03 + .01 = .11 → 11%

d.) What percent of U.S. households have no more than 3 people living together?

.25 + .32 + .17 = .74 → 74%

Simulation Activity:

Roll a pair of dice forty times and find the sum of the dice that is rolled for each trial. Write your information on the provided table.

Trial #	Dice # 1	Dice # 2	Sum of Dice	Trial #	Dice # 1	Dice # 2	Sum of Dice
1	4	6	10	21			
2	5	2	7	22			
3				23			
4				24			
5				25			
6				26			
7				27			
8				28			
9				29			
10				30			
11				31			
12				32			
13				33			
14				34			
15				35			
16				36			
17				37			
18				38			
19				39			
20				40			

THIS IS YOUR DATA!

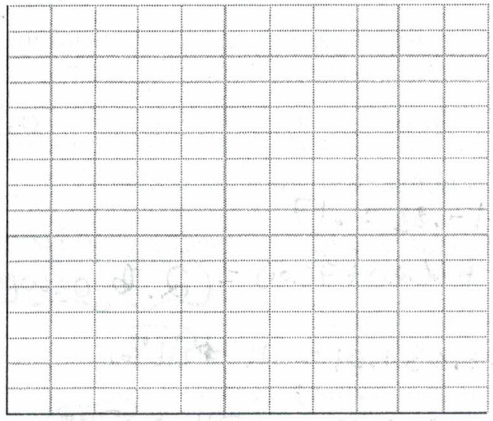
Frequ

2
3
4
5
6
7 |
8
9
10 |
11
12

a.) Complete the probability table from your chart above. Hint: Denominator in the probability row should be 36 (from multiplying $\frac{1}{6}\times\frac{1}{6}=\frac{1}{36}$) but each numerator should be different based on its sum from your simulated activity.

X = Sum	2	3	4	5	6	7	8	9	10	11	12
Prob as a fraction	/36	/36	/36	/36	/36	/36					

b.) Make a histogram of your probability table.



c.) Which sum showed up the most frequent?

d.) A certain sum will show up more than any others. What sum do you think this is? EXPLAIN!!