

Assignment 15: Probability (5.7)

Name _____

Please provide a handwritten response.

Figure 5.58 gives a histogram based on probabilities for the number of heads appearing in an eight-coin toss. Using *Maple*'s `rand` command, we can simulate the repeated tossing of eight coins together and keep track of the number of heads appearing in each toss. Then we can create a histogram describing our experiment, and compare it to Figure 5.59.

1a. We can simulate tossing one coin with the command

```
n:=rand(0..1):n();
```

which generates either 0 or 1 at random, each with probability $\frac{1}{2}$; we interpret the outcome of “1” as representing “heads” and “0” as representing “tails”. Execute this command ten times and list the results below.

1b. We can simulate tossing eight coins at once; execute

```
[seq(n(), i=1..8)];
```

three times and record the results below. Also record how many 1's (“heads”) appeared in each toss.

1c. We are really interested only in the number of heads appearing in each toss of the eight coins. Because the tails are represented by “0” and the heads by “1”, a convenient way to count the heads is simply to toss a coin eight times and add the results. Execute

```
add(i, i=[seq(n(), i=1..8)]);
```

three times and record the results below. (The counter `i` is used here simply to help the `add` command keep track of when to start and stop.) How large could this number be? How small?

1d. Now we are ready to generate data for our histogram. Execute

```
coin:=proc() f:=seq(n(), i=1..8); A:=add(i, i=f); end:
h:=[seq(coin(x), i=1..25)];
```

to simulate tossing the eight coins together twenty-five times, and enter the result below. (*Maple* gives you some information about the variables telling you which are local when you execute the procedure.)

1e. Enter in the table on the next page the number of occurrences in part **d** of each possible outcome, as a fraction of the total of twenty-five tosses. A sample is provided, but your specific numbers will probably be different.

# of heads	0	1	2	3	4	5	6	7	8
Occurrences	$\frac{0}{25}$	$\frac{1}{25}$	$\frac{1}{25}$	$\frac{5}{25}$	$\frac{10}{25}$	$\frac{4}{25}$	$\frac{3}{25}$	$\frac{1}{25}$	$\frac{1}{25}$
(Sample)	$\frac{0}{25}$	$\frac{0}{25}$	$\frac{1}{25}$	$\frac{5}{25}$	$\frac{10}{25}$	$\frac{4}{25}$	$\frac{3}{25}$	$\frac{1}{25}$	$\frac{1}{25}$

1f. We want a list of all the possible outcomes preceded by the frequency with which each outcome actually occurred. The command below would create such a list according to the data in the sample row of the table. Execute this command after you have changed the underlined numbers 0, 0, 1, etc. to the numbers you recorded in the table. (Do not try to underline your numbers when entering them!)

```
L:= [Weight(0,0),Weight(1,0),Weight(2,1),Weight(3,5),
Weight(4,10),Weight(5,4),Weight(6,3),Weight(7,1),Weight(8,1)
];
```

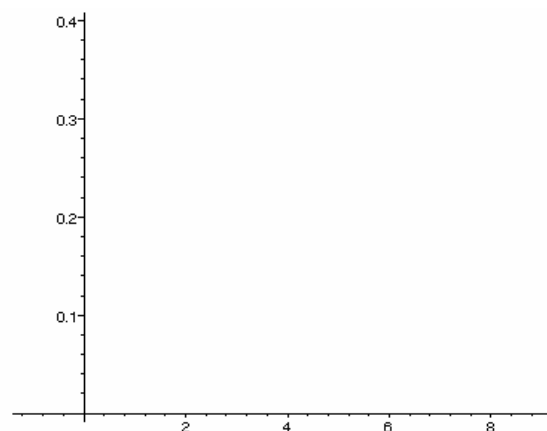
1g. To draw our histogram we must first load in two packages; execute

```
with(stats);with(statplots);
```

followed by

```
xshift(-0.5,xscale(9/8,
  histogram(L,area=1,
    numbars=9)));
```

and sketch the result on the diagram at right. How closely does your histogram resemble Figure 5.58?



1h. We can repeat this “experiment” using 500 tosses provided *Maple* counts the frequencies of occurrence for us. Execute the command

```
h:= [seq(coin(x), i=1..500)]:
```

(Include the colon! It prevents *Maple* from printing this long result on the screen.) Next count the occurrences by executing

```
L:=transform[tally](h);
```

To plot the histogram, again execute

```
xshift(-0.5,xscale(9/8,histogram(L,area=1,numbars=9)));
```

Does this histogram more closely resemble Figure 5.58 than your result in part g?