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ELEC 3800 – project1

Due: 08/26/21

1. What is the relative frequency of heads?

Code:

```
trials = 100;  
flip= rand(trials,1);  
heads = (flip>= 0.5);  
percentheads = sum(heads)/trials
```

Answer:

percentheads = 0.5400 or 54%

2. What is the lowest relative frequency you get? Why isn't it always 0.5?

Answer:

After performing the experiment ten times, the lowest relative frequency obtained was 0.4200 or 42%. It is not always 0.5 because each trial has an equal chance to be heads or tails. This causes the overall percentage of heads to vary.

Table 1		
Experiment Number (N = 100)	Result	Percentage
1	0.4400	44%
2	0.4900	49%
3	0.4600	46%
4	0.5000	50%
5	0.5000	50%
6	0.5600	56%
7	0.4600	46%
8	0.4200	42%
9	0.5100	51%
10	0.5400	54%

3. What is happening to the variation of the relative frequency as the number of trials increases? Why?

Answer:

The variation of the relative frequency is diminishing as the number of trials increases. As the sample size of the experiment increases, the results will become more accurate. Therefore, if the number of trials is increased by a factor of ten, the precision of the results will more accurately reflect the theoretical value of 0.5.

Table 2		
Experiment Number (N = 1,000)	Result	Percentage
1	0.5180 (51.80%)	51.80%
2	0.5120 (51.20%)	51.20%
3	0.5240 (52.40%)	52.40%
4	0.4960 (49.60%)	49.60%
5	0.4870 (48.70%)	48.70%
6	0.5170 (51.70%)	51.70%
7	0.4980 (49.80%)	49.80%
8	0.4770 (47.70%)	47.70%
9	0.5160 (51.60%)	51.60%
10	0.5060 (50.60%)	50.60%

Table 3		
Experiment Number (N = 10,000)	Result	Percentage
1	0.4997	51.80%
2	0.5017	51.20%
3	0.4992	52.40%
4	0.4957	49.60%
5	0.4941	48.70%
6	0.4997	51.70%
7	0.5074	49.80%
8	0.5021	47.70%
9	0.5008	51.60%
10	0.5037	50.60%

4. What is the probability of getting four heads in a row? What would the percentage be if the experiment is performed 10,000 times? 100,000?

Code:

```
trials = 100000;
flip = rand(trials,4);
heads = (flip >= 0.5);
ALL4 = sum(all(heads,2));
percentheads = ALL4/trials
```

Answer:

Table 4		
Calculated Percentage	N = 10,000	N = 100.000
$(\frac{1}{2})(\frac{1}{2})(\frac{1}{2})(\frac{1}{2}) = 0.0625$	0.0611 or 6.11%	0.0634 or 6.34%

5. How likely is it that the result will show a fair coin by giving a relative frequency of 50% or higher? Does 100 flips appear to be enough trials to reliably detect an unfair coin with a 45% probability of heads?

Code:

```
trials = 1000;
numFlips = 100;
fliparray = rand(numFlips, trials);
heads = (fliparray >= 0.55);
percentheads = sum(heads)/numFlips;

faircoin = (percentheads >= 0.50);
detect = sum(faircoin)/trials
```

Answer:

The result will show a fair coin 17.3% of the time. Although this is a relatively low amount of times, I would say that one may not notice the coin was unfair if it landed on heads 17 times. However, if the number of flips was changed to 1000, the probability of detecting heads will diminish to nearly zero. This effect will lead to the unfair coin being noticed reliably. In conclusion, if I were a gambling man, I would only allow someone to use my weighted coin around 100 times in order to conceal my trick.