ECE 341 - Homework #12

t-Test with a Single Population. Summer 2024

6-Card Stud Poker

The computed odds of being dealt a full-house in 6-card poker are in homework set #2.

1) The result of four Monte-Carlo simulations with 100,000 poker hands are:

```
811   805   809   804
```

From these results, determine the 90% confidence interval for the odds of being dealt a full-house

The t-score for 5% tails and 3 degrees of freedom (sample size = 4) is

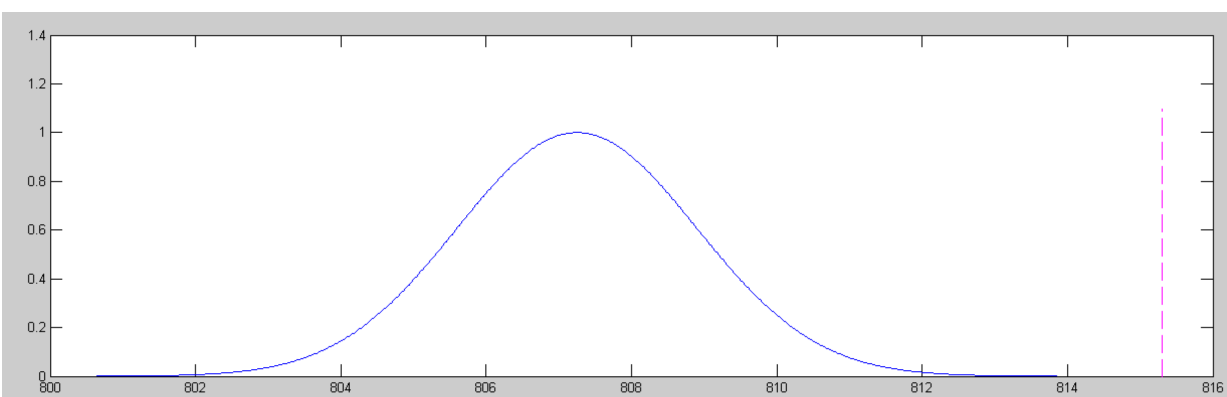
t = 2.355

The 90% confidence interval is (803.3595, 811.1405)

- calculated odds: 815.3048 in 100,000 hands
- The data suggests the calculations were slightly high

Note: This is a population question (trying to find the population's mean). Divide the variance by the sample size

```
>> Data = [811   805   809   804 ];
>> x = mean(Data)

x =  807.2500

>> s = std(Data) / sqrt(4)

s =    1.6520

>> x + 2.355*s

ans =  811.1405

>> x - 2.355*s

ans =  803.3595

>>
```



6-Card Stud Poker

2) The result of twenty Monte-Carlo simulations with 100,000 poker hands are:

```
811    805    809    804    837    830    841    770    889    821
850    754    786    763    754    855    785    724    815    823
```

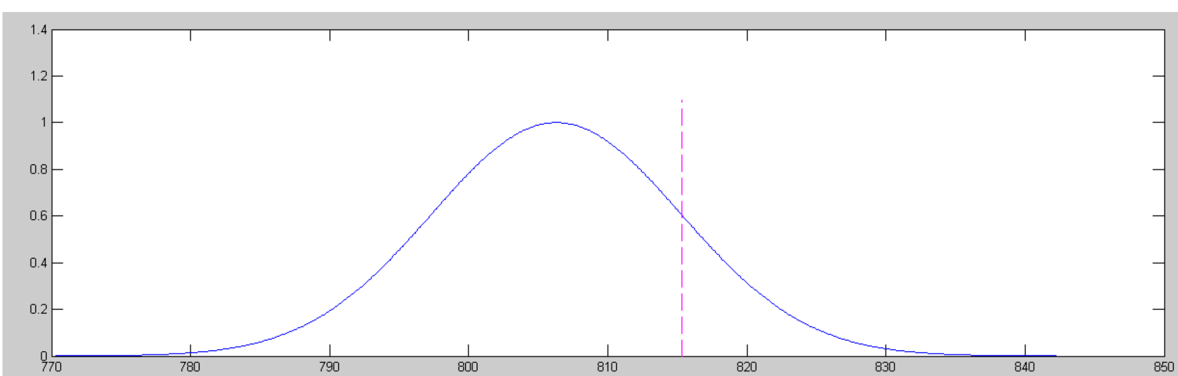
From these results, determine the 90% confidence interval for the odds of getting a full-house.

- The t-score for 5% tails and 19 degrees of freedom is 1.729

The 90% confidence interval is (790.7496, 821.8504) in 100,000 hands

- Calculated odds are 815.3048 in 100,000 hands
- This *is* within the calculated 90% confidence interval, so calculations *might* be correct

```
>> DATA = [811   805   809   804   837   830   841   770   889   821 850   754
786   763   754   855   785   724   815   823];
>> x = mean(DATA)

x =  806.3000

>> n = length(DATA)

n =    20

>> s = std(DATA) / sqrt(n)

s =    8.9939

>> x + 1.729*s

ans =  821.8504

>> x - 1.729*s

ans =  790.7496

>>
```



6-Card Draw

The computed odds of getting a full house in 6-card poker with a draw step was found in homework #2

3) The result of four Monte-Carlo simulations with 100,000 poker hands are:

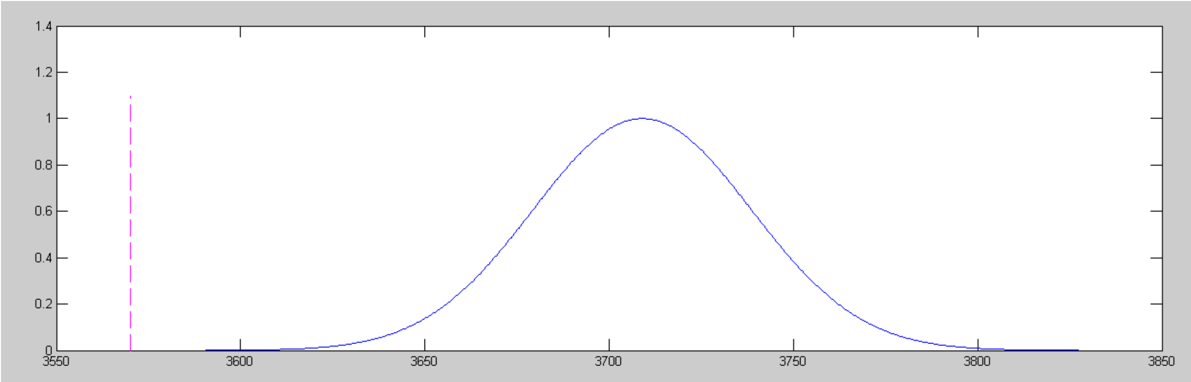
```
3747   3633    3764    3692
```

From these results, determine the 90% confidence interval for the odds of getting a full-house.

90% confidence interval = (3639.2, 3778.8)

- Calculated odds are 3570 in 100,000 hands

```
>> DATA = [3747   3633    3764    3692];
>> n = length(DATA)

n =     4

>> x = mean(DATA)

x =        3709

>> s = std(DATA) / sqrt(n)

s =   29.6283

>> x + 2.355*s

ans =  3.7788e+003

>> x - 2.355*s

ans =  3.6392e+003
```



6-Card Draw (sample size = 20)

4) The result of twenty Monte-Carlo simulations with 100,000 poker hands are:

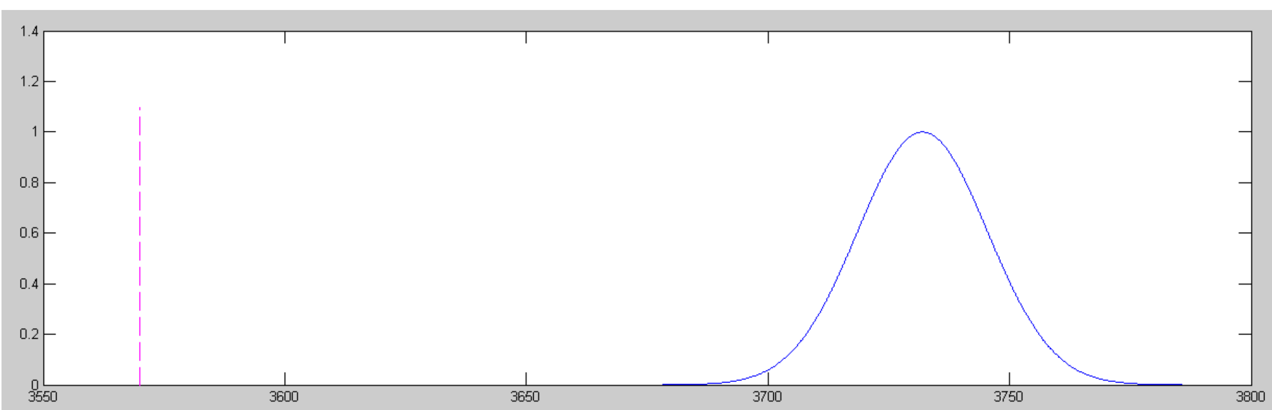
```
3747   3633   3764   3692   3760   3793   3778   3708   3786   3650
3664   3777   3744   3788   3739   3620   3701   3759   3848   3693
```

From these results, determine the 90% confidence interval for the odds of getting a full house.

90% confidence interval = (3709.0, 3755.4)

- Calculated odds are 3570 in 100,000 hands
- probably, the calculations are off or the Monte-Carlo simulation has errors

```
>> DATA = [3747   3633   3764   3692   3760   3793   3778   3708   3786   3650 3664   3777
 3744   3788   3739   3620   3701   3759   3848   3693];

>> n = length(DATA)

n =    20

>> x = mean(DATA)

x =  3.7322e+003

>> s = std(DATA) / sqrt(n)

s =   13.4434

>> x + 1.729*s

ans =  3.7554e+003

>> x - 1.729*s

ans =  3.7090e+003

>>
```



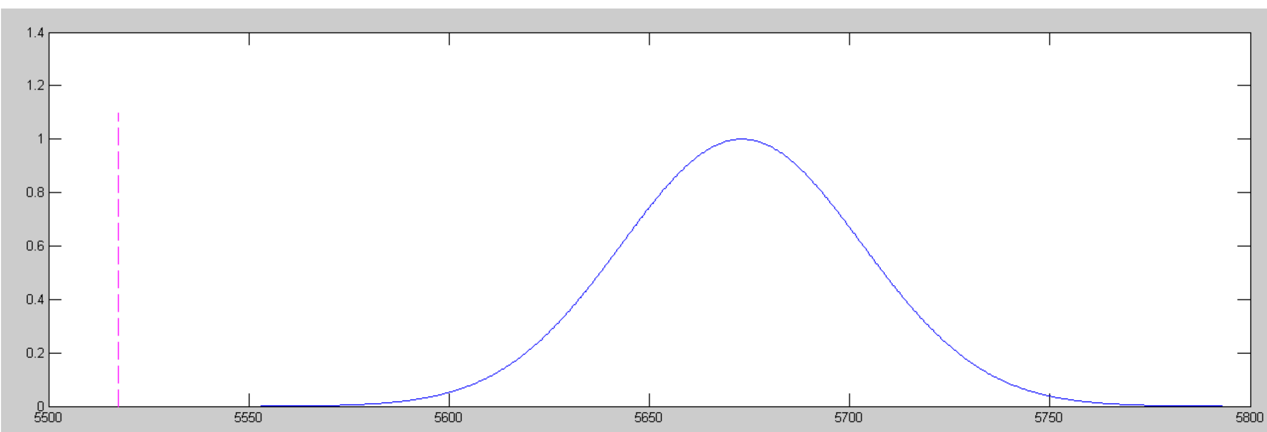
Repeating with corrected code:

```
 5663, 5833, 5576, 5602, 5587, 5623, 5787, 5751, 5579, 5730
```

```
>> DATA = [5663, 5833, 5576, 5602, 5587, 5623, 5787, 5751, 5579, 5730];
>> x = mean(DATA)

x =  5.6731e+003

>> s = std(DATA)

s =   94.9918

>> s = std(DATA) / sqrt(10)

s =   30.0390

>> x + 1.833*s

ans =  5.7282e+003

>> x - 1.833*s

ans =  5.6180e+003
```

The 90% confidence interval is (5618.0, 5728.2)

- Calculated odds are 5517.4
- It appears calculations were a little low



Reaction Time

5) Go to the Human Benchmark Dashboard and record your reaction time

`https://humanbenchmark.com/tests/reactiontime`

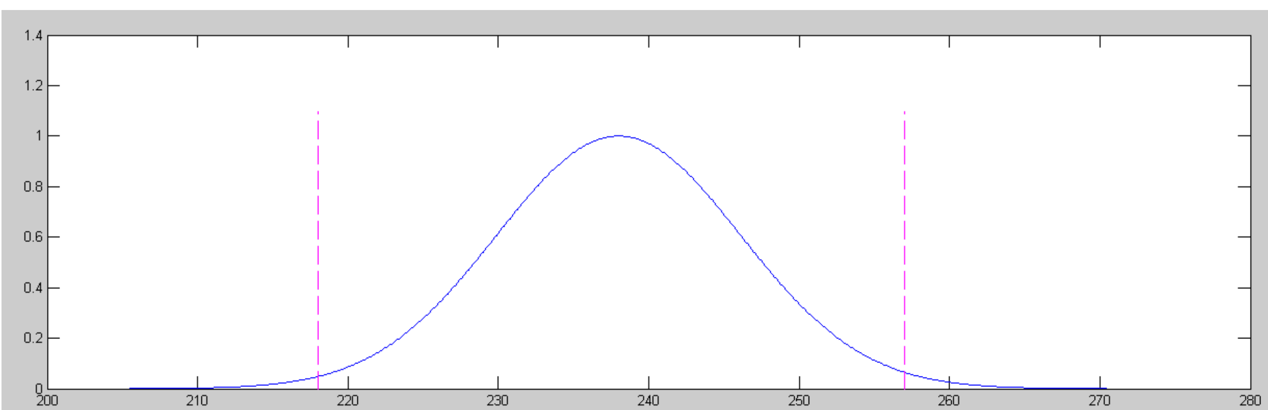
Times: {230ms, 248ms, 233ms, 241ms}

6) From your results, determine the 90% confidence interval for your reaction time.

In this case, it's an individual test (one more trial) so you do not divide by the square-root of sample size

The 90% confidence interval for any given trial is (218.86ms, 257.13ms)

```
>> DATA = [230,248,233,241];
>> x = mean(DATA)

x =   238

>> s = std(DATA)

s =    8.1240

>> x + 2.355*s

ans =  257.1321

>> x - 2.355*s

ans =  218.8679

>>
```



7) From your results, determine the probability that

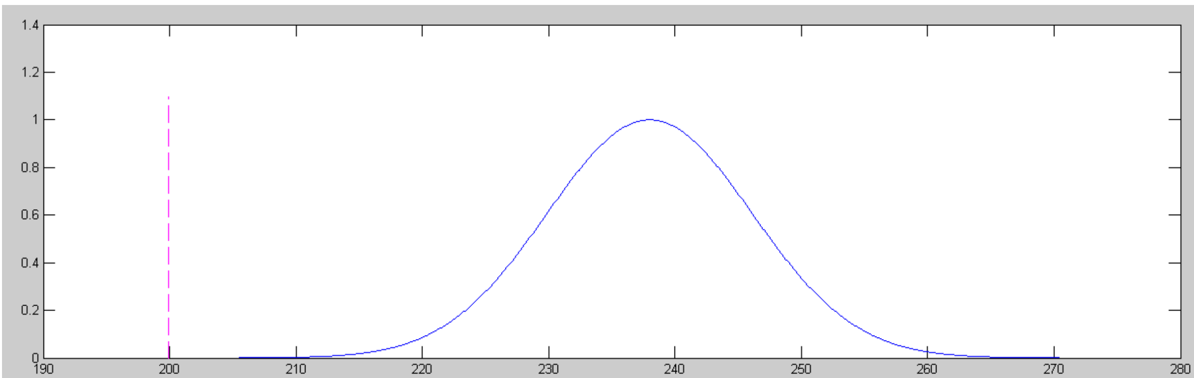
Your next trial will be less than 200ms

Individual Case. The t-score is

```
>> t = (200 - x)/s

t =   -4.6775
```

From StatTrek, a t-score of 4.6775 with 3 degrees of freedom corresponds to a probability of 0.009

There is a 0.9% chance my next score will be less than 200ms

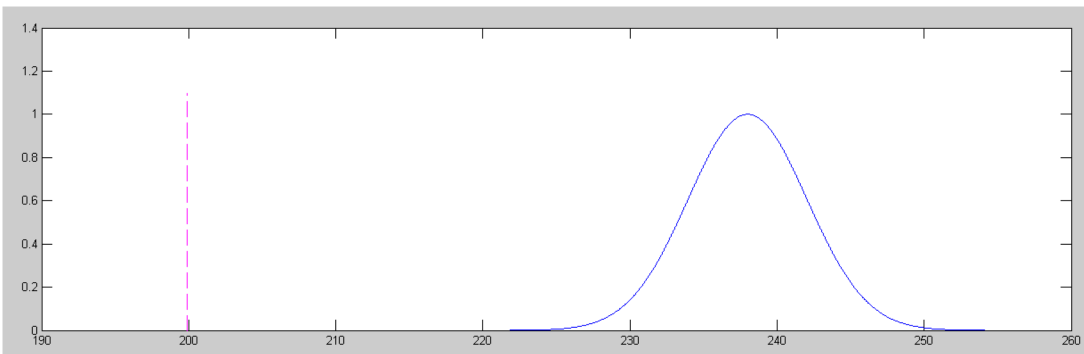


Your average reaction time is less than 200ms

Population (my average reaction time)

```
>> n = length(DATA)

n =      4

>> s = std(DATA) / sqrt(n)

s =     4.0620

>> t = (200 - x)/s

t =   -9.3550
```

From StatTrek this corresponds to a probabilty of 0.001



There is a 0.1% chance my average score will is less than 200ms