4. **Take Home Part of Exam 2: Due Monday Apr. 11 (Hand in With your Exam).**

Name in Block Capitals: _____

The following statistics are taken from the regular season data for Stephen Curry on ESPN.

4.1. **Question 1: Comparing 2 Proportions.** The following table shows the number of 3 point shots made (3PM) out of 3 point shots attempted (3PA) in regular season games in Jan. and Feb. of 2016 by Stephen Curry along with his 3 point percentage (3P%= 3PM/3PA) for those months.

	3PTM	3PTA	3PT%
Jan.	73 x_1	138 n_1	0.529 ← $\hat{p}_1$
Feb.	81 x_2	176 n_2	0.46 ← $\hat{p}_2$

The 3P% for each month can be used (as we saw in the early notes on probability) as an estimate of the true probability of Stephen Curry making a 3 point shot in a game for both of the above months.
Let p_1 denote the probability of Stephen Curry making a 3 point shot in January 2016 and
Let p_2 denote the probability of Stephen Curry making a 3 point shot in February 2016.

Assignment: Test the Null Hypothesis
H_0: $p_1 - p_2 = 0$ against the Alternative Hypothesis:
$H_A : p_1 \neq p_2$ at a 5% level of significance.

Using the notation in the notes above, find values for

$\hat{p} =$ 0.4904, $\sigma_{\hat{p}_1-\hat{p}_2}, =$ 0.057, Test Statistic z = = 1.21.

Write down a decision rule:
REJECT H_0 IF $|z| > 2$

What is your decision? DO NOT REJECT H_0
Reject H_0 at a 5% level of significance or
Do not reject H_0 at a 5% level of significance.

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{73 + 81}{138 + 176} = \frac{154}{314} = 0.4904$$

$$\sigma_{\hat{p}_1 - \hat{p}_2} = \sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \approx \sqrt{(0.49)(0.51)\left(\frac{1}{138} + \frac{1}{176}\right)} \approx \sqrt{0.003231}$$

$$\approx 0.0568$$

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sigma} = \frac{0.069}{0.0568} = 1.21$$

4.2. **Question 2: Comparing 2 means.** The following sets of data show points per minute played for games played by Stephen Curry in the regular season for two years.

Data Set 1: Points per minute played for 81 games played by Stephen Curry in the regular season in 2014/2015 (the average here is $\bar{x}_1 \approx 0.722$).

0.526, 0.517, 0.971, 1.286, 0.714, 0.8, 0.407, 0.824, 0.75, 0.833, 1.118, 0.943, 0.857, 0.75, 0.593, 0.533, 0.576, 0.926, 0.265, 1, 0.375, 0.71, 0.514, 0.897, 0.974, 0.88, 0.529, 0.941, 0.781, 0.556, 0.694, 0.625, 0.71, 0.722, 1.378, 0.793, 0.676, 0.941, 0.488, 0.667, 0.345, 0.647, 0.8, 0.818, 0.613, 1, 0.931, 0.657, 0.6, 0.613, 0.941, 0.481, 0.806, 0.389, 0.733, 0.462, 0.81, 0.487, 0.85, 0.784, 0.541, 0.677, 0.528, 0.613, 0.611, 0.571, 0.813, 1.167, 1.081, 0.395, 0.32, 1, 0.679, 0.531, 0.444, 0.824, 0.85, 0.824, 0.677, 0.912, 0.649,

Data Set 2: Points per minute played for 71 games played by Stephen Curry in the regular season in 2015/2016 (the average here is $\bar{x}_2 \approx 0.883$).

0.606, 0.943, 0.892, 0.543, 0.368, 0.912, 1.214, 0.871, 1, 1.172, 0.375, 1.108, 0.529, 0.892, 1.211, 1.5, 1.167, 1, 0.639, 1.192, 0.897, 0.867, 0.921, 0.684, 1.417, 0.406, 0.676, 0.438, 1.321, 1.054, 0.735, 1.25, 1.027, 0.867, 0.95, 0.816, 1, 0.897, 0.654, 0.938, 0.357, 0.767, 0.514, 0.471, 0.667, 0.833, 0.8, 0.809, 0.806, 0.875, 1.158, 1.29, 0.703, 0.633, 1.323, 0.8, 0.679, 0.75, 1.081, 0.925, 0.773, 1.211, 0.8, 0.595, 0.615, 0.971, 0.939, 1.071, 1.472, 0.926, 1.111

Let μ_1 be the average points per minute played per game for Stephen Curry in the 2014/2015 season and Let μ_2 be the average points per minute played per game for Stephen Curry in the 2015/2016 season.

Assignment: Test the Null Hypothesis
H_0: $\mu_2 - \mu_1 = 0$ against the Alternative Hypothesis:
$H_A : \mu_2 - \mu_1 > 0$ at a 1% level of significance ($\alpha = 0.01$)
using the Mathematica T-Test.

Step 1 Copy the above sets of data into Mathematica as two lists named `data1` (for Data Set 1 above) and `data2` (for Data Set 2 above).

Step 2 Find the p-value of the data by running the TTest with the options shown below:

```
In[47]:= TTest[{data1, data2}, 0, "TestDataTable"]
```

Step 3 Run the TTest at a 1% level of significance using the commands shown below:

```
TTest[{data1, data2}, 0, "TestConclusion", SignificanceLevel → 0.01,
 AlternativeHypothesis → "Less"]
```

Step 4 Give an interpretation of your results below and print out the Mathematica results and attach them to the take home part of your exam with your name on them.

SEE ATTACHED PRINTOUT OF MATHEMATICA RESULTS

THE NULL HYPOTHESIS IS REJECTED AT A 1% LEVEL OF SIGNIFICANCE
THEREFORE THERE HAS BEEN A (STATISTICALLY) SIGNIFICANT INCREASE IN POINTS PER MINUTE PER GAME FOR STEPHEN CURRY IN THE 2015/2016 SEASON WHEN COMPARED TO THE 2014/2015 SEASON.

```
p1 = 0.529
```

```
0.529
```

```
x1 = 73
```

```
73
```

```
n1 = 138
```

```
138
```

```
p1 = N[x1 / n1]
```

```
0.528986
```

```
p2 = .46
```

```
0.46
```

```
x2 = 81
```

```
81
```

```
n2 = 176
```

```
176
```

```
p2 = N[x2 / n2]
```

```
0.460227
```

```
p = N[(x1 + x2) / (n1 + n2)]
```

```
0.490446
```

```
v = p (1 - p) ((1 / n1) + (1 / n2))
```

```
0.00323087
```

```
s = Sqrt[v]
```

```
0.0568407
```

```
T = (p1 - p2) / s
```

```
1.20966
```

```
Needs["HypothesisTesting`"]
```

```
NormalPValue[1.209664864120361`, TwoSided → True]
```

```
TwoSidedPValue → 0.226408
```

```
Needs["HypothesisTesting`"]
```

```
data1 = {0.526, 0.517, 0.971, 1.286, 0.714, 0.8, 0.407, 0.824, 0.75, 0.833, 1.118,
  0.943, 0.857, 0.75, 0.593, 0.533, 0.576, 0.926, 0.265, 1, 0.375, 0.71, 0.514,
  0.897, 0.974, 0.88, 0.529, 0.941, 0.781, 0.556, 0.694, 0.625, 0.71, 0.722,
  1.378, 0.793, 0.676, 0.941, 0.488, 0.667, 0.345, 0.647, 0.8, 0.818, 0.613, 1,
  0.931, 0.657, 0.6, 0.613, 0.941, 0.481, 0.806, 0.389, 0.733, 0.462, 0.81, 0.487,
  0.85, 0.784, 0.541, 0.677, 0.528, 0.613, 0.611, 0.571, 0.813, 1.167, 1.081,
  0.395, 0.32, 1, 0.679, 0.531, 0.444, 0.824, 0.85, 0.824, 0.677, 0.912, 0.649}
```

```
{0.526, 0.517, 0.971, 1.286, 0.714, 0.8, 0.407, 0.824, 0.75, 0.833, 1.118, 0.943,
 0.857, 0.75, 0.593, 0.533, 0.576, 0.926, 0.265, 1, 0.375, 0.71, 0.514, 0.897,
 0.974, 0.88, 0.529, 0.941, 0.781, 0.556, 0.694, 0.625, 0.71, 0.722, 1.378,
 0.793, 0.676, 0.941, 0.488, 0.667, 0.345, 0.647, 0.8, 0.818, 0.613, 1, 0.931,
 0.657, 0.6, 0.613, 0.941, 0.481, 0.806, 0.389, 0.733, 0.462, 0.81, 0.487,
 0.85, 0.784, 0.541, 0.677, 0.528, 0.613, 0.611, 0.571, 0.813, 1.167, 1.081,
 0.395, 0.32, 1, 0.679, 0.531, 0.444, 0.824, 0.85, 0.824, 0.677, 0.912, 0.649}
```

```
data2 = {0.606, 0.943, 0.892, 0.543, 0.368, 0.912, 1.214, 0.871, 1, 1.172, 0.375, 1.108,
  0.529, 0.892, 1.211, 1.5, 1.167, 1, 0.639, 1.192, 0.897, 0.867, 0.921, 0.684,
  1.417, 0.406, 0.676, 0.438, 1.321, 1.054, 0.735, 1.25, 1.027, 0.867, 0.95, 0.816,
  1, 0.897, 0.654, 0.938, 0.357, 0.767, 0.514, 0.471, 0.667, 0.833, 0.8, 0.809,
  0.806, 0.875, 1.158, 1.29, 0.703, 0.633, 1.323, 0.8, 0.679, 0.75, 1.081, 0.925,
  0.773, 1.211, 0.8, 0.595, 0.615, 0.971, 0.939, 1.071, 1.472, 0.926, 1.111}
```

```
{0.606, 0.943, 0.892, 0.543, 0.368, 0.912, 1.214, 0.871, 1, 1.172, 0.375, 1.108,
 0.529, 0.892, 1.211, 1.5, 1.167, 1, 0.639, 1.192, 0.897, 0.867, 0.921, 0.684,
 1.417, 0.406, 0.676, 0.438, 1.321, 1.054, 0.735, 1.25, 1.027, 0.867, 0.95, 0.816,
 1, 0.897, 0.654, 0.938, 0.357, 0.767, 0.514, 0.471, 0.667, 0.833, 0.8, 0.809,
 0.806, 0.875, 1.158, 1.29, 0.703, 0.633, 1.323, 0.8, 0.679, 0.75, 1.081, 0.925,
 0.773, 1.211, 0.8, 0.595, 0.615, 0.971, 0.939, 1.071, 1.472, 0.926, 1.111}
```

```
TTest[{data1, data2}, 0, "TestDataTable"]
```

	Statistic	P-Value
T	−4.02447	0.0000902958

```
TTest[{data1, data2}, 0, "TestConclusion",
 SignificanceLevel → 0.01, AlternativeHypothesis → "Less"]
```

```
The null hypothesis that the mean difference is greater than or equal to 0
 is rejected at the 1. percent level based on the T test.
```