Thanksgiving Statistics Activity

Name: _____

Date:_____

Directions:

Patrick runs a catering business that is preparing for the Thanksgiving holiday. Patrick caters dinners for large parties with a maximum of 25 guests each. He has over 20 dinner parties booked for Thanksgiving this year and all parties have the maximum amount of guests allowed. Patrick knows he needs to purchase large turkeys for the dinners. Since roughly one pound of turkey feeds one person, he will need close to a 25 pound bird for each Thanksgiving dinner. This size will ensure that every guest gets turkey. In Patrick's town of Beacon Hill there are two markets that sell whole turkeys. Sunnyvale Market has 502 turkeys for sale while Knotted Hill Market has 523 turkeys. Both of the markets send out a flyer each year with a random sample of turkeys for sale along with each turkey's weight and price. Patrick checks the lists to see which market will have the larger turkeys. Since the lists include random samples, Patrick will need help in determining which market has the larger turkeys.

Sunnyvale Market

Turkey Number	Turkey Weight (lbs)	Price ($)
1	21.4	23.54
2	22.1	24.31
3	22.0	24.20
4	22.5	24.75
5	21.0	23.10
6	24.0	26.40
7	23.3	25.63
8	23.0	25.30
9	23.3	25.63
10	10.2	11.22

Turkey Number	Turkey Weight (lbs)	Price ($)
11	23.9	26.29
12	24.5	26.95
13	19.9	21.89
14	20.1	22.11
15	23.6	25.96
16	25.2	27.72

Knotted Hill Market

Turkey Number	Turkey Weight (lbs)	Price ($)
1	29.9	32.89
2	25.0	27.50
3	25.5	28.05
4	22.4	24.64
5	23.7	26.07
6	24.2	26.62
7	26.8	29.48
8	25.8	28.38
9	25.6	28.16
10	17	18.70
11	25.2	27.72
12	26.1	28.71
13	24.2	26.62
14	24.1	26.51
15	30.0	33.00
16	25.3	27.83

Patrick knows the first step is to calculate the average (mean) and standard deviation of turkey weights at each market.*

Average weight (lbs) of turkeys at Sunnyvale Market: _____

Average weight (lbs) of turkeys at Knotted Hill Market:_____

Standard deviation (lbs) of weights at Sunnyvale Market:_____

Standard deviation (lbs) of weights at Knotted Hill Market:_____

*Use Calculation Sheet to determine standard deviation.

Patrick knows the next step is to calculate the difference between the average turkey weight at Sunnyvale Market and Knotted Hill Market.

Absolute difference of mean weights at each market:_____

Patrick knows there is a difference between the average weights, but doesn't know if this difference is significant. He then calculates the variance of the average turkey weight. To calculate the variance, simply square the standard deviation.

Variance of turkey weight at Sunnyvale Market:_____

Variance of turkey weight at Knotted Hill Market:_____

Calculation Sheet

Market Name	Turkey Weight (lbs)	Difference between Mean Weight and Turkey Weight (lbs)	(Difference)^(2)
Sunnyvale	21.4	| 21.88 - | = 0.48	(0.48)^2 = 0.2304
	22.1	| 21.88 - | = 0.22	(0.22)^2 = 0.0484
	22.0	| 21.88 - | =	( )^2 =
	22.5		
	21.0		
	24.0		
	23.3		2.0164
	23.0		
	23.3		
	10.2		
	23.9		4.0804
	24.5		
	19.9		
	20.1		
	23.6		2.9584
	25.2		
		Total Squared Difference:	
	$\sqrt{\frac{\sum(x-\bar{x})^2}{(n-1)}}$	Standard Deviation:	3.46
Knotted Hill	29.9	| - 29.9 | = 4.85	
	25.0	| - 25.0 | = 0.05	
	25.5		

Market Name	Turkey Weight (lbs)	Difference between Mean Weight and Turkey Weight (lbs)	(Difference)^(2)
	22.4		
	23.7		
	24.2		
	26.8		3.0625
	25.8		
	25.6		0.3025
	17		
	25.2		
	26.1		
	24.2		0.7225
	24.1		
	30.0		
	25.3		
		Total Squared Difference:	
	$\sqrt{\frac{\sum(x-\bar{x})^2}{(n-1)}}$	Standard Deviation:	

Patrick is unsure of what to do next and asks for your help. You know that to test two independent samples you need the formula for a Student's T-test.

$$\text{T-value} = [\, |X_1 - X_2| \,] / [\, \text{sqrt}((\sigma^2_1 / n_1) + (\sigma^2_2 / n_2))]$$

Where X_1 is the average turkey weight at Sunnyvale Market and X_2 is the average turkey weight at Knotted Hill Market.

The σ^2_1 symbol denotes the variance of turkey weight at Sunnyvale Market and the σ^2_2 denotes the variance of turkey weight at Knotted Hill Market.

The n_1 represents the sample size for Sunnyvale Market and n_2 represents the sample size for Knotted Hill Market.

Sample size for Sunnyvale Market: 16

Sample size for Knotted Hill Market: 16

T-value from formula:_____

You also will need to compare this T-value to the T-value from a normal distribution. To do this, calculate the degrees of freedom of the two samples.

Degrees of freedom = $n_1 + n_2 - 2$

(Hint: look above for what n_1 and n_2 represent)

Degrees of freedom of the two samples: _____

The normal distribution for 30 degrees of freedom and 0.05 significance level is 2.04. If this value is less than the calculated T-value above, then we know with 95% certainty that there is a significant difference between the average turkey weight at each market.

Which T-value is greater?

_____ is greater than _____

Since the calculated T-value is _____ (greater or less than? Hint: look above) the T-value from a normal distribution, Patrick now knows there is a statistically significant difference between the turkey weights at each market. _____ Market has the larger turkeys! Patrick concludes with 95% certainty that _____ Market will have the larger turkeys for the Thanksgiving holiday! He thanks you for your help in preparing his business for Thanksgiving Day! Congratulations on a job well-done!

BONUS:
The turkeys are priced based on size, if Patrick purchases 25 turkeys for 21 dinners on Thanksgiving Day, how much will it cost? (Hint: The price per pound is the same at both markets)

ANSWERS:

Average (mean) turkey weight at Sunnyvale Market: 21.88 lbs

Average (mean) turkey weight on Knotted Hill Market: 25.05 lbs

Standard deviation of turkey weight Sunnyvale Market: 3.46 lbs

Standard deviation of turkey weight Knotted Hill Market: 2.94 lbs

Absolute difference between the two average weights: 3.17 lbs

Variance of average weight of turkeys at Sunnyvale Market: 11.97

Variance of average weight of turkeys at Knotted Hill Market: 8.64

Resulting Student's t-test value: 2.79

Degrees of freedom of 2 samples: 30

_____2.79_____ is greater than _____2.04_____

Knotted Hill Market has the larger turkeys. We reject the null hypothesis that there is no statistically significant difference between the turkey weight at the two markets. The average turkey weight at Knotted Hill Market is statistically greater than the average turkey weight at Sunnyvale Market (significance level = 0.05).

BONUS: In the table, turkeys are priced at 1.03567 per pound.
25 lbs of turkey x 21 dinners x $ 1.10 per pound = $ 577.50