Due Wednesday, July 27, 2022 (11:59 pm)

Problem 1**:** A manufacturer claims that the average tensile strength of thread A exceeds the average tensile strength of thread B by at least 12 kilograms. To test this claim, 50 pieces of each type of thread were tested under similar conditions. Type A thread had an average tensile strength of 86.7 kilograms with a standard deviation of 6.28 kilograms, while type B thread had an average tensile strength of 77.8 kilograms with a standard deviation of 5.61 kilograms. Test the manufacturer's claim using a 0.05 level of significance.

Sample= 50
A: mean = 86.7, deviation 6.28
B: mean = 77.8, deviation 5.61

H_0: A – B ≤ 12
H_1 : A – B > 12

Equation:

$$z = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

(86.7 – 77.8) – 12 / sq(6.28^2/50 + 5.61^2/50) = 8.9 – 12/ sq(1.41821) = -3.1/ 1.19089 = -2.603 -> .0047 which gives 1- 0.0047 = 0.9953 -> P value

We can conclude that the null hyp is plausible and that there isn't enough evidence to say the average strength between the two won't be less 12.

Problem 2**:** The following data represent the running times of films produced by two motion-picture companies:

Company	Time (minutes)						
I	102	86	98	109	92		
II	81	165	97	134	92	87	114

Test the hypothesis that the average running time of films produced by company 2 exceeds the average running time of films produced by company 1 by 10 minutes against the one-sided alternative that the difference is less than 10 minutes. Use a 0.1 level of significance and assume the distributions of times to be approximately normal with unequal variances.

H_0: comp2 – comp1 ≤ 10
H_1: comp2 – comp1 > 10

Equation

$$df = \frac{\left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right]^2}{\frac{(s_1^2/n_1)^2}{n_1-1} + \frac{(s_2^2/n_2)^2}{n_2-1}}$$

Excel work

Comp1	Comp2							
102	81				s1^2/n	s2^2/n	sum	sum^2
86	165			Top of eq	130.4761905	15.76	146.23619	21385.0234
98	97							
109	134			bottom of eq	s1^2/n)^2/n-1	s2^2/n)^2/n-2	sum	
92	92				2431.005183	48.67552	2479.6807	
	87							
	114			df	8.624103651			
97.4	110	Mean						
8.876936	30.22141	deviation						
5	7	size		2.6		0.215003691		
s2	s1			12.09281566				

T = (110-97.4) – 10/ sq(30.22141^2/7 + 8.87^2/5) = 2.6/ 12.09 = 0.215

Not on the table given, would probably be between 0.5 and 0.4, so the P value would be > 0.1 so we fail to reject the null hyp meaning there isn't enough evidence to say that the avg run time will exceed 10.

***Problem 3*:** In a winter of an epidemic flu, the parents of 2000 babies were surveyed by researchers at a well-known pharmaceutical company to determine if the company's new medicine was effective after two days.
Among 120 babies who had the flu and were given the medicine, 29 were cured within two days. Among 280 babies who had the flu but were not given the medicine, 56 recovered within two days. Is there any significant indication that supports the company's claim of the effectiveness of the medicine? Use a 0.05 level of significance.

Size: 2000
Of 120, 29 cured within 2 days, given medicine (px)
Of 280, 56 recovered within 2 days, no medicine (py)

P_x - P_y
H_0: given medicine is as effective as none (=)
H_1: given medicine is better than none (>)

P_x = 29/120 = 0.24167 P_y = 56/280 = 0.2 P = 85/400 = 0.2125

Z = 0.24167-0.2/ sq(0.2125(1-0.2125)(1/120 + 1/280)) = 0.04167/0.0446 = 0.93359 ->1-0.8238 = 0.1762 (p value)

The P value is greater than the 0.05 significance level so we fail to reject the null hyp and can conclude that there is not enough evidence that the new medicine is more effective.

***Problem 4*:** In a study to estimate the proportion of residents in a certain city and its suburbs who favor the construction of a nuclear power plant, it is found that 63 of 100 urban residents favor the construction while only 59 of 125 suburban residents are in favor. Is there a significant difference between the proportions of urban and suburban residents who favor construction of the nuclear plant? Use a 0.05 level of significance.

63/100 urban
59/125 suburban

H_0: there is no difference (=)
H_1: is a difference (≠)
P_u = 63/100 = 0.63 P_s = 59/125 = 0.472 P = 63+59/ 100+125 = 0.542

Z = 0.63 – 0.472 / sq(0.542(1-0.542)(1/100 + 1/125)) = 0.158 / 0.06684 = 2.36

0.9909 -> 1 – 0.9909 = 0.0091
0.0091

P value = 0.0091*2 = 0.0182 < 0.05

We reject the null hyp and can conclude that there is a difference between the suburban and urban favor of the plant with the urban population having a larger proportion in favor of it.