

Math 21 Online – Final Review

- For sample size problems, just state the appropriate sample size.
- For confidence interval problems, express your answer in a sentence.
- For hypothesis tests, use the standard 5-step procedure.
 1. H_0 & H_1
 2. α
 3. test
 4. test statistic & p-value
 5. Decision about H_0 and conclusion

1) A news agency is planning a poll. The agency wants to determine what proportion of American citizens supported NATO involvement in Kosovo. If the agency wants to be 95% sure that the sample proportion differs from the true population proportion by no more than 4%, how large of a sample is necessary?

2) A high school counselor wants to estimate the mean SAT combined score for high school students. He has been told that the standard deviation for all such scores is approximately 230 points. How large of a sample is required in order to be 99% sure that his sample mean is off by no more than 10 points from the true mean SAT combined score.

3) A sample of 350 Americans were asked if they had ever seen a UFO, and 14 said that they had. Construct an 84% confidence interval for the proportion of all Americans who have seen a UFO.

4) Here are the ages of a random sample of 10 men who first married in 1998.

28	25	18	18	19	34	21	25	24	24
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Construct a 95% confidence interval for the mean age at which men get married.

5) A sample of 340 Americans were asked whether they thought that UFO's are real, and 146 said that they thought that UFO's are real. At the 0.05 level of significance, test the claim that less than half of all Americans think that UFO's are real.

6) A random sample of 36 COS students revealed that 10 of them owned an iPhone. At the 0.05 level of significance test the claim that less than 40% of COS students own an iPhone.

7) The Harris Poll conducted a survey in which they asked, "How many tattoos do you currently have on your body?"

- Of the 1205 males surveyed, 181 responded that they had at least one tattoo.
- Of the 1097 females surveyed, 143 responded that they had at least one tattoo.

Test the claim that the proportion of males that have at least one tattoo is different than the proportion of females that have at least one tattoo, at the 0.05 level of significance.

8) A random sample of 25 COS students had 16 female students. A random sample of 100 Fresno State students had 52 female students. At the 0.05 level of significance, test the claim that the proportion of female students at COS is higher than it is at Fresno State.

9) A random sample of 23 symphony musicians was asked how many hours they practiced their instrument per week. The survey produced a mean practice time of 6.2 hours with a standard deviation of 2.36 hours per week. At the 0.05 level of significance, test the claim that the mean time that symphony musicians practice per week is greater than 5 hours per week.

10) An experimental math exam was given to 8 students. Test the claim that the mean score is above 70 at the 0.05 level of significance.

64 77 85 78 81 89 79 80

11) To test the belief that sons are taller than their fathers, a student randomly selects 13 fathers who have adult male children. She records the height of both the father and son in inches and obtains the following data. Test the claim that sons are taller than their fathers at the 0.05 level of significance.

Family	1	2	3	4	5	6	7	8	9	10	11	12	13
Father	70.3	67.1	70.9	66.8	72.8	70.4	71.8	70.1	69.9	70.8	70.2	70.4	72.4
Son	74.1	69.2	66.9	69.2	68.9	70.2	70.4	69.3	75.8	72.3	69.2	68.6	73.9

12) A random sample of 9 Math 200 students took a practice final exam one week before their final exam. Use the data to test the claim that students improve their scores from the practice test to the actual exam at the 0.05 level of significance.

Student	1	2	3	4	5	6	7	8	9
Practice	74	70	85	81	76	90	65	84	52
Final	71	81	98	90	84	99	78	91	61

13) Do people walk faster in the airport when they are departing (getting on a plane) or when they are arriving (getting off a plane)? A researcher measured the walking speed of travelers in two airports.

- 35 departing passengers had a mean walking speed of 260 feet/minute, with a standard deviation of 53 feet/minute.
- 35 arriving passengers had a mean walking speed of 269 feet/minute, with a standard deviation of 34 feet/minute.

Test the claim that the mean walking speed for departing passengers is different than the mean walking speed for arriving passengers at the 0.05 level of significance.

14) A student wants to test the claim that male college students are taller than female college students at the 0.05 level of significance. Here are the heights, in inches, of randomly selected college students.

Male 74 71 75 72 70 82
Female 68 66 64 63 69 65 70 60

15) A geneticist claims that one parent with brown eyes and a second parent with green eyes will produce offspring with the following eye-color distribution: 50% brown, 37.5% green, 12.5% blue. Here are the eye colors of 200 children that have one parent with brown eyes and one parent with green eyes.

Color	Brown	Green	Blue
Frequency	112	70	18

Test the geneticist's claim at the 0.05 level of significance.

16) Does a person's gender influence their ice cream preference? A random sample of individuals were asked to name their favorite ice cream flavor. Here are the results, broken down by gender.

	Chocolate	Vanilla	Other
Male	80	30	90
Female	40	90	70

Test the claim that ice cream preference is independent of gender at the 0.05 level of significance.

17) Here are the waiting times, in minutes, at the check-in counters for four different airlines at an airport for randomly selected fliers.

Airline A	Airline B	Airline C	Airline D
3	19	8	7
11	13	11	16
19	11	17	15
11	13	7	9
7		12	
10			

At the 0.05 level of significance, test the claim that the mean waiting time at the checkout counters of the four airlines are equal.

18) Here are the ages of randomly selected students in Math 200, Math 230, and Math 21. Use the data to test the claim that the mean age of all students in those three classes are equal. Use $\alpha = 0.05$.

Math 200 18 35 22 46 24 18 20
Math 230 19 20 22 18 25
Math 21 21 19 20 22 18 18 18 19

Part 2 – For the following hypothesis tests, the test statistic and P-value have already been calculated for you using StatCrunch. Write up the hypothesis tests using the 5-step procedure.

1) 500 people were asked their income level and political affiliation.

	Republican	Democrat	Independent
\$50,000 or lower	30	110	100
Above \$50,000	120	50	90

At the 0.05 level of significance, test the claim that political affiliation is independent of income level.

(Test Statistic: 76.35, p-value < 0.0001)

2) A company is studying the absence patterns of its workers. A sample of 362 absences showed the following results:

Day	Mon	Tue	Wed	Thu	Fri
Absences	87	62	71	68	74

At the 0.05 level of significance, test the claim that the proportion of absences is the same for each day of the week.

(Test Statistic: 4.77, p-value: 0.3119)

3) A manufacturer is considering two methods for assembling chairs, and uses each method to assemble 25 different chairs. Method A produced a mean assembly time of 6.5 minutes, with a standard deviation of 1.30 minutes. Method B produced a mean assembly time of 6.2 minutes with a standard deviation of 1.36 minutes. Test the claim that the two methods have the same mean assembly time at the 0.01 level of significance.

(Test Statistic: 0.80, p-value: 0.4292)

4) A sample of 607 Americans reveals that 137 of them smoke cigarettes. Use this sample information to test the claim that more than 20% of all Americans smoke, at the 0.05 level of significance.

(Test Statistic: 1.58, p-value: 0.0567)

5) A new company claims that the average monthly long distance bill is less than \$20. A sample of 36 of their customers produced a mean monthly bill of \$19.18. If the population standard deviation is \$3.87, test the company's claim at the 0.01 level of significance.

(Test Statistic: -1.27, p-value: 0.1018)

6) In a study conducted at LAX, 81 of 300 persons who had just gotten off a plane and 32 of 200 persons who were about to get on a plane admitted that they were afraid of flying. At the 0.05 level, test the claim that the two population proportions are not equal.

(Test Statistic: 2.88, p-value: 0.004)

7) To compare two kinds of baseball bats, 18 players were asked to swing 20 times with each kind of bat at balls pitched by a machine. Here are the numbers of home runs that they hit.

Aluminum Bat	6	9	4	7	10	5	9	3	5	6	12	8	5	4	9	10	7	11
Wooden Bat	8	5	4	6	8	6	7	4	4	6	9	9	5	6	6	8	7	7

At the 0.05 level, test the claim that more home runs are hit with an aluminum bat than with a wooden bat.

(Test Statistic: 1.84, p-value: 0.0413)

8) A farmer tried 4 different fertilizers to determine which was the most effective. He applied each fertilizer to 5 different tomato plants, and measured the yield of each plant. Here are the results, in pounds.

Fert. A	Fert. B	Fert. C	Fert. D
57	49	53	39
51	55	56	45
50	54	46	42
52	48	48	37
56	50	55	40

Test the claim, at the 0.05 level of significance, that each fertilizer produces the same mean yield.

(Test Statistic: 13.85, p-value: 0.0001)

9) There are dozens of hypothesis tests that we do not cover in this class. The following is an example of a two variance test, which compares the variance of one population to the variance of another population. (The symbol for variance is σ^2 .) The test is performed in a manner that is very similar to the two-mean or two-proportion test. Perform the two-variance test for the following problem.

A nurse was interested in discovering whether men have more variability in their systolic blood pressure than women. She randomly selects 20 males and 17 females from the surgical floor of her hospital and records their systolic blood pressures. The females had a mean blood pressure of 125.2 with a standard deviation of 10.35, while the males had a mean blood pressure of 125.7 with a standard deviation of 14.60. At the 0.05 level of significance, test the claim that males have more variance in their systolic blood pressure than women do.

(Test Stat: 0.50 p-value: 0.0844)

10) Here is an excerpt of an article from a medical journal. Read through it, determine which test was being performed, and write it up using our standard 5-step procedure using the 0.05 level of significance.

Effects of Exenatide and Insulin Glargine on Body Mass Index (BMI).

METHODS

In this single-blind study, 117 patients were given 5 mcg of Exenatide twice daily and 114 other patients were given Insulin Glargine. They were divided into the two groups randomly. Body Mass Index (BMI) was recorded at the beginning of the study, and once again after 26 weeks.

RESULTS

Patients taking Exenatide experienced a net mean decrease of 0.95 ($s = 1.19$), while patients taking Insulin Glargine experienced a net gain of 1.01 ($s = 1.17$). The difference in BMI change between the 2 treatments was statistically significant. ($t = -12.62$, $P\text{-value} < 0.001$).

CONCLUSION

While both medications show positive effects regarding the regulation of insulin in Type-2 diabetes patients, they do have different effects when it comes to helping patients avoid weight gain. To determine whether use of Exenatide aids Type-2 diabetes patients with weight loss will require further testing.