

Which Test Quiz – 1 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

- A. Independent group means, population standard deviations known (z-test)
- B. Independent group means, population standard deviations unknown (t-test)
- C. Matched or paired samples (z-test)
- D. Matched or paired samples (t-test)
- E. Single mean (z-test)
- F. Single mean (t-test)
- G. Two proportions
- H. Single proportion
- I. Mann-Whitney non-paired test for medians
- J. Wilcoxon Signed Rank Test for paired data
- K. Wilcoxon Signed Rank Test for single sample median.
- L. Chi-Squared test for Goodness of fit
- M. Chi-Squared test for Association in a contingency table

- a) A new SAT study course is tested on 12 individuals. Pre-course and post-course scores are recorded. Of interest is the mean increase in SAT scores. The following data are collected:

Pre-course score	Post-course score
1200	1300
960	920
1010	1100
840	880
1100	1070
1250	1320
860	860
1330	1370
790	770
990	1040
1110	1200
740	850

- b) Patients undergoing routine surgery are given medication to relieve post-operative pain. The medication is known to relieve pain in 0.85 of cases. A new medication, claimed to be more effective, becomes available and of a random sample of 150 patients 140 report that their pain was relieved. Test the claim that the new medication is more effective at the 1% level of significance.
- c) Parents of teenage boys often complain that auto insurance costs more, on average, for teenage boys than for teenage girls. A group of concerned parents examines a random sample of insurance bills. The mean annual cost for 36 teenage boys was \$679. For 23 teenage girls, it was \$559. From past years, it is known that the population standard deviation for each group is \$180. Determine whether or not you believe that the mean cost for auto insurance for teenage boys is greater than that for teenage girls.
- d) A packing process packages ground coffee into bags. The weight of each bag is normally distributed with mean 500g and standard deviation 10g. A random sample of 25 bags is taken and the sample mean is found to be 495g. Test the claim that there has been a change in the population mean at the 5% level of significance and state the p-value.

Which Test Quiz – 2 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

- A. Independent group means, population standard deviations known (z-test)
 - B. Independent group means, population standard deviations unknown (t-test)
 - C. Matched or paired samples (z-test)
 - D. Matched or paired samples (t-test)
 - E. Single mean (z-test)
 - F. Single mean (t-test)
 - G. Two proportions
 - H. Single proportion
 - I. Mann-Whitney non-paired test for medians
 - J. Wilcoxon Signed Rank Test for paired data
 - K. Wilcoxon Signed Rank Test for single sample median.
 - L. Chi-Squared test for Goodness of fit
 - M. Chi-Squared test for Association in a contingency table
- a) A new clerical program was introduced to a large company with the hope that clerical errors would be reduced. 5,000 clerical workers in the company underwent the training program. 50 Clerical employees who underwent the training were randomly selected. The average number of clerical errors that each of these 50 employees made per month for six months prior to the training and also for six months following the training were recorded. Each of the 50 employees had a similar degree of clerical experience within the company and performed nearly the same volume and type of clerical work in the before and after months. The standard deviation of the after-before differences for all 5,000 employees who underwent the training is known to be 6.4.
- b) Marketing companies have collected data implying that teenage girls use more ring tones on their mobile phones than teenage boys do. In one particular study of 40 randomly chosen teenage girls and boys (20 of each) with cellular phones, the mean number of ring tones for the girls was 3.2 with a standard deviation of 1.5. The mean for the boys was 1.7 with a standard deviation of 0.8.
Conduct a hypothesis test to determine if the means are approximately the same or if the girls' mean is higher than the boys' mean.
- c) A researcher believes that in recent years women have been getting taller. She knows that 10 years ago the average height of young adult women living in her city was 63 inches. The standard deviation is unknown.
She randomly samples eight young adult women currently residing in her city and measures their heights.
The following data are obtained: 64, 66, 68, 60, 62, 65, 66, 63
- d) While her husband spent 2½ hours picking out new speakers, a statistician decided to determine whether the percentage of men who enjoy shopping for electronic equipment is higher than the percentage of women who enjoy shopping for electronic equipment. The population was Saturday afternoon shoppers. Out of 67 men, 24 said they enjoyed the activity. 8 of the 24 women surveyed claimed to enjoy the activity. Interpret the results of the survey.

Which Test Quiz – 3 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

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- C. Matched or paired samples (z-test)
- D. Matched or paired samples (t-test)
- E. Single mean (z-test)
- F. Single mean (t-test)
- G. Two proportions
- H. Single proportion
- I. Mann-Whitney non-paired test for medians
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- L. Chi-Squared test for Goodness of fit
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- a) A football league reported that the mean number of touchdowns per game was 5. A study is done to determine if the mean number of touchdowns has decreased.
- b) Eight runners were convinced that the mean difference in their individual times for running one mile versus race walking one mile was at most 2 minutes. Below are their times. Do you agree that the mean difference is at most 2 minutes?

Running time (minutes)	Race walking time (minutes)
5.1	7.3
5.6	9.2
6.2	10.4
4.8	6.9
7.1	8.9
4.2	9.5
6.1	9.4
4.4	7.9

- c) The values below are the scores (maximum 20) obtained in an aptitude test by a random sample of 11 graduates. It is known that for the non-graduate population the median score is 12. Is there evidence, at the 10% significance level, that graduates achieve a higher median score than the non-graduate population?

14 15 9 10 10 13 14 19 12 16 13

- d) According to a YWCA Rape Crisis Center newsletter, 75% of rape victims know their attackers. A study is done to verify this.

Which Test Quiz – 4 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

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- C. Matched or paired samples (z-test)
- D. Matched or paired samples (t-test)
- E. Single mean (z-test)
- F. Single mean (t-test)
- G. Two proportions
- H. Single proportion
- I. Mann-Whitney non-paired test for medians
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- L. Chi-Squared test for Goodness of fit
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- a) A girl has a choice of two different routes to school, A and B. She suspects that route A is quicker but to test this she records the times taken on 4 journeys by route A and 4 by route B. The results were:

times in minutes for route A	23	24	22	18
times in minutes for route B	26	25	32	21

- b) Joan Nguyen recently claimed that the proportion of college-age males with at least one pierced ear is as high as the proportion of college-age females. She conducted a survey in her classes. Out of 107 males, 20 had at least one pierced ear. Out of 92 females, 47 had at least one pierced ear. Do you believe that the proportion of males has reached the proportion of females?
- c) The following values are the annual salaries, in £, of a random sample of 10 recent statistics' graduates.
13250 7485 15136 12258 11019 14268 19536 14326 16326 17984
Investigate the claim, at the 10% significance level, that the median annual salary of all recent statistics' graduates exceeds £12 000.
- d) We are interested in whether children's educational computer software costs less, on average, than children's entertainment software. 36 educational software titles were randomly picked from a catalogue. The mean cost was \$31.14 with a standard deviation of \$4.69. Separately, 35 entertainment software titles were randomly picked from the same catalogue. The mean cost was \$33.86 with a standard deviation of \$10.87. Decide whether children's educational software costs less, on average, than children's entertainment software.

Which Test Quiz – 5 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

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- C. Matched or paired samples (z-test)
- D. Matched or paired samples (t-test)
- E. Single mean (z-test)
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- G. Two proportions
- H. Single proportion
- I. Mann-Whitney non-paired test for medians
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- L. Chi-Squared test for Goodness of fit
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- a) The following table gives the number of days between breakdowns for two different makes of vending machines. Are both makes of machine equally reliable?

Make A	34	26	39	10	50	26	167	85	2	32
Make B	87	281	185	59	116	170	202	196	51	71

- b) Ten individuals went on a low-fat diet for 12 weeks to lower their cholesterol. Evaluate the data below. Do you think that their cholesterol levels were significantly lowered?

Starting cholesterol level	Ending cholesterol level
140	140
220	230
110	120
240	220
200	190
180	150
190	200
360	300
280	300
260	240

- c) Mean entry level salaries for college graduates with mechanical engineering degrees and electrical engineering degrees are believed to be approximately the same. A recruiting office thinks that the mean mechanical engineering salary is actually lower than the mean electrical engineering salary. The recruiting office randomly surveys 50 entry level mechanical engineers and 60 entry level electrical engineers. Their mean salaries were \$46,100 and \$46,700, respectively. Their standard deviations were \$3450 and \$4210, respectively. Conduct a hypothesis test to determine if you agree that the mean entry level mechanical engineering salary is lower than the mean entry level electrical engineering salary
- d) According to a recent study, U.S. companies have a mean maternity-leave of six weeks.

Which Test Quiz – 6 of 8

For the following situations, decide which of the following choices best identifies the hypothesis test that would be applied

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- a) A group of transfer bound students wondered if they will spend the same mean amount on texts and supplies each year at their four-year university as they have at their community college. They conducted a random survey of 54 students at their community college and 66 students at their local four-year university. The sample means were \$947 and \$1011, respectively. The population standard deviations are known to be \$254 and \$87, respectively. Conduct a hypothesis test to determine if the means are statistically the same.

- b) It is claimed by a local resident that more than 50% of all the vehicles on an urban road exceed the 30 mph speed limit. The speed of each of a random sample of 24 vehicles is recorded with the following results.

42 35 24 30 32 42 56 35
34 30 29 41 38 38 30 29
34 39 43 72 38 40 30 62

Investigate the resident's claim.

- c) A golf instructor is interested in determining if her new technique for improving players' golf scores is effective. She takes four new students. She records their 18-holes scores before learning the technique and then after having taken her class. She conducts a hypothesis test. The data are as follows.

	Player 1	Player 2	Player 3	Player 4
Mean score before class	83	78	93	87
Mean score after class	80	80	86	86

- d) Neuroinvasive West Nile virus refers to a severe disease that affects a person's nervous system. It is spread by the Culex species of mosquito. In the United States in 2010 there were 629 reported cases of neuroinvasive West Nile virus out of a total of 1021 reported cases and there were 486 neuroinvasive reported cases out of a total of 712 cases reported in 2011. Is the 2011 proportion of neuroinvasive West Nile virus cases more than the 2010 proportion of neuroinvasive West Nile virus cases? Using a 1% level of significance, conduct an appropriate hypothesis test.

Which Test Quiz – 7 of 8

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 - L. Chi-Squared test for Goodness of fit
 - M. Chi-Squared test for Association in a contingency table
- a) A shop selling telephones found that, during 1993, approximately 20% of customers chose the colour white. During the early weeks of 1994, a random sample of 200 sales indicated that 53 involved the choice of a white telephone. Test the shop manager's claim that the demand for white telephones has increased.
- b) A manufacturer of a type of low wattage light bulb claims that the bulb will last for 2000 hours with standard deviation 80 hours. A random sample of 50 bulbs was taken and the mean lifetime was found to be 1980 hours. Is the manufacturer exaggerating the lifetime of this type of light bulb? Test at the 1% level and state the p value of the test.
- c) The following data shows the age at diagnosis of type II diabetes in young adults. Is the age at diagnosis different for males and females?
Males: 19 22 16 29 24
Females: 20 11 17 12
- d) Some manufacturers claim that non-hybrid sedan cars have a lower mean miles per gallon (mpg) than hybrid ones. Suppose that consumers test 21 hybrid sedans and get a mean of 31 mpg with a standard deviation of 7 mpg. Thirty-one non-hybrid sedans get a mean of 22 mpg with a standard deviation of 4 mpg. Suppose that the population standard deviations are known to be 6 and 3, respectively. Conduct a hypothesis test to the manufacturers claim.

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- a) The shell lengths of mussels from an estuary may be assumed to be normally distributed with mean 30 mm and standard deviation 10 mm. Given that the random sample of 25 mussels from a polluted beach had mean shell length of 26 mm, state whether or not you would consider that there was evidence to suggest that the pollution inhibits the growth of mussels.
- b) A powder diet is tested on 49 people and a liquid diet is tested on 36 different people. The population standard deviations are 2 pounds and 3 pounds, respectively. Of interest is whether the liquid diet yields a higher mean weight loss than the powder diet.
- c) One of the questions in a study of marital satisfaction of dual-career couples was to rate the statement, "I'm pleased with the way we divide the responsibilities for childcare." The ratings went from 1 (strongly agree) to 5 (strongly disagree). Below are ten of the paired responses for husbands and wives. Conduct a hypothesis test to see if the difference in the husband's versus the wife's satisfaction level is negative (meaning that, within the partnership, the husband is happier than the wife).

Wife's score	2	2	3	3	4	2	1	1	2	4
Husband's score	2	2	1	3	2	1	1	1	2	4

- d) Lesley E. Tan investigated the relationship between left-handedness and right-handedness and motor competence in preschool children. Random samples of 41 left-handers and 41 right-handers were given several tests of motor skills to determine if there is evidence of a difference between the children based on this experiment. The experiment produced the means and standard deviations shown below. Determine the appropriate test and best distribution to use for that test.

	Left-handed	Right-handed
Sample size	41	41
Sample mean	97.5	98.1
Sample standard deviation	17.5	19.2