

Class Examples with solutions

1. A trucking company claims that the average weight of a fully loaded moving van is 12,000 lb. The highway patrol decides to check this claim. A random sample of 30 moving vans shows that the average weight is 12,100 lb. with a standard deviation of 800 lb. Construct a hypothesis test to determine whether the average weight of a moving van is more than 12,000 lb. Use a 5% level of significance.
2. A cigarette company claims that their cigarettes contain an average of only 10 mg of tar. A random sample of 100 cigarettes shows the average tar content to be 11 mg with standard deviation 4.5 mg. Construct a hypothesis test to determine whether the average tar content of cigarettes exceeds 10 mg. Use a 3% level of significance.
3. Jerry is doing a project for his sociology class in which he tests the claim that the Pleasant View housing project contains family units of average size 3.3 people (the national average). A random sample of 64 families from Pleasant View project shows a sample mean of 3.8 people per family unit with sample standard deviation 1.3. Construct a hypothesis test to determine whether the average size of a family unit in Pleasant View is different from the national average of 3.3. Use a 2% level of significance.
5. A loan company claims that the average amount of money on deposit in a savings account in their bank is \$7,500. Suppose a random sample of 49 accounts shows the average amount on deposit to be \$7,175 with sample standard deviation \$1,200. Construct a hypothesis test to determine whether the average amount on deposit per account is different from \$7,500. Use a 1% level of significance.
6. Some professional football players seem to earn tremendous amounts of money. However, their careers as professional players are short. One sports magazine reported that the average career length is 4.3 years. A random sample of 40 retired players showed a sample mean career length of 5.2 years with standard deviation 2.3 years. Construct a hypothesis test to determine whether the average career in professional football is longer than 4.3 years. Use a 5% level of significance.
7. Killer bees have migrated into this country. There is fear that they will spread across the nation. However, they cannot survive in cold climates. It is thought that they cannot tolerate temperatures below 36° F. To test this claim a random sample of 9 killer bee hives were subjected to colder and colder temperatures until they died. The temperatures at which the hives died were recorded. The mean temperature was 38° F with standard deviation 4° F. Assuming that the killing temperature level is normally distributed, test the claim that the mean killing temperature is different from 36° F. Use a 1% level of significance.
8. Statistical Abstracts (117th edition) reports that the average amount spent annually for food by householders under 25 years of age is \$2,690. A random sample of 16 people under 25 years of age who live in a university neighborhood were surveyed. The survey showed that they spent a sample mean \$3,220 with sample standard deviation \$750. Test the claim that the mean for this neighborhood is greater than the national average. Use a 5% significance level.
9. Statistical Abstracts (117th edition) reports that the national average amount a single person spends annually for housing is \$10,465. A random sample of 20 householders living in the San Francisco Bay area had a sample mean housing cost \$14,575 with standard deviation \$4,580. Test to see if the mean housing cost in the San Francisco Bay area is higher than the national average. Use a 1% significance level.

10. Statistical Abstracts (117th edition) reports that the average annual expenditure for health care by individuals 25 to 34 years old is \$1,096. A random sample of 24 athletes between the ages of 25 and 34 had a sample mean expenditure of \$950 with sample standard deviation \$425. Test to see if the mean expenditure for health care for athletes between the ages of 25 and 34 is different from the national average. Use a 1% significance level.
11. Last year the average daily change in the Dow Jones Industrial Index was 7.3 points. A random sample of 15 trading days this year showed the average change to be 5.2 points with standard deviation 3.4. Test the claim that the average change in the index is less this year than it was last year. Use a 5% significance level.
12. Statistical Abstracts (117th edition) reports that the average number of days per year that it rains more than 0.01 inches in Albuquerque, New Mexico is 61. A random sample of 6 years of weather records from a mountain community west of Albuquerque had sample mean 75 days per year with sample standard deviation 12.4 days per year. Test to see if the mean number of rainy days in the mountain community is different from that in Albuquerque. Use a 5% significance level.
13. Ruth is concerned about the spending habits of teens. She read a report that the national weekly spending average for teens in the age group 12 to 15 years is \$42. She took a random sample of 60 teens who live in a rural area and found that they spent an average of \$40 per week with sample standard deviation \$7.50. Test the claim that rural teens from this area spend less than the national average. Use a 1% significance level.

ANSWERS

- [1] $H_0: \mu = 12,000$; $H_1: \mu > 12,000$; $Z_0 = 1.645$; $z = 0.685$; P value: 0.2467; Do not reject H_0 . At 5% level of significance we have insufficient evidence to conclude that average weight of a moving van is greater than 12,000 lb.
- [2] $H_0: \mu = 10$ mg; $H_1: \mu > 10$ mg; $Z_0 = 1.88$; $z = 2.22$; P value: 0.0132; Reject H_0 . At 3% level of significance we have sufficient evidence to conclude that average amount of tar is greater than 10 mg.
- [3] $H_0: \mu = 3.3$; $H_1: \mu \neq 3.3$; $Z_0 = \pm 1.96$; $z = 3.08$; P value: 0.0010. Reject H_0 . At 2% level of significance we have sufficient evidence to conclude that average size of a family is different from the national average.
- [5] $H_0: \mu = \$7,500$; $H_1: \mu \neq \$7,500$; $Z_0 = \pm 2.58$; $z = -1.89$; P -value: 0.0598; Fail to Reject H_0 . At 1% level of significance we have insufficient evidence to conclude that average amount on deposit is different from \$7,500.
- [6] $H_0: \mu = 4.3$ yr; $H_1: \mu > 4.3$ yr; $Z_0 = 1.645$; $z = 2.79$; P - value: 0.0026; Reject H_0 . At 5% level of significance we have sufficient evidence to conclude that average career in professional football is longer than 4.3 years.
- [7] $H_0: \mu = 36^\circ\text{F}$; $H_1: \mu \neq 36^\circ\text{F}$; $t_0 = 3.355$; $t = 1.5$ P value is between 0.05 and 0.10. Do not

reject H_0 . We cannot conclude that the mean killing temperature for the bees is different from 36°F.

[8] $H_0: \mu = \$2,690$; $H_1: \mu > \$2,690$; $t_0 = 1.753$; $t = 2.8267$; P value is between 0.005 and 0.01. Reject H_0 . The mean amount spent for food by people under 25 years of age in this neighborhood is greater than the national average.

[9] $H_0: \mu = \$10,465$; $H_1: \mu > \$10,465$; $t_0 = 2.539$; $t = 4.0132$; P value is less than 0.005. Reject H_0 . The mean cost of housing in the San Francisco Bay area is greater than the national average.

[10] $H_0: \mu = \$1,096$; $H_1: \mu \neq \$1,096$; $t_0 = \pm 2.807$; $t = -1.68$; P value is between 0.10 and 0.20. Do not reject H_0 . The mean expenditure for health care by athletes is not different from the national average expenditure for all persons in this age range.

[11] $H_0: \mu = 7.3$; $H_1: \mu < 7.3$; $t_0 = -1.761$; $t = -2.40$; P value is between 0.01 and 0.025. Reject H_0 . The index is less this year than it was last year.

[12] $H_0: \mu = 61$; $H_1: \mu \neq 61$; $t_0 = \pm 2.571$; $t = 2.77$; P value is between 0.02 and 0.05. Reject H_0 . The mean number of rainy days is different in the mountain community than it is in Albuquerque.

[13] $H_0: \mu = \$42$; $H_1: \mu < \$42$; $Z_0 = -2.33$; $z = -2.07$; P value: 0.0192. Reject H_0 . Rural teens from the area spend less than the national average.