# Excel exercises

# One population test

# Example 11.2 AT&T (Xm11-02)

- In recent years, a number of companies have been formed that offer competition to AT&T in long-distance calls. All advertise that their rates are lower than AT&T's, and as a result their bills will be lower.

- AT&T has responded by arguing that for the average consumer there will be no difference in billing. Suppose that a statistics practitioner working for AT&T determines that the mean and standard deviation of monthly long-distance bills for all its residential customers are $17.09 and $3.87, respectively.

- He then takes a random sample of 100 customers and recalculates their last month's bill using the rates quoted by a leading competitor.

- Assuming that the standard deviation of this population is the same as for AT&T, can we conclude at the 5% significance level that there is a difference between AT&T's bills and those of the leading competitor?

# Example 12.1 Newspaper recycling plant (Xm12-01)

- We need to do more to save the environment. Possible actions includes reducing energy use and recycling.
- Recycled materials are more expensive than those manufactured from material found in the earth.
- Newspaper can be profitable to recycle newspaper. However, the major expense is the collection from homes.
- The firm would make a profit if the mean weekly newspaper collection from each household exceeded 2 pounds
- We have 148 sample sizes. Does these data provide sufficient evidence to allow us to conclude that a recycling plant would be profitable at 5% significance level?

# Example 12 .3 Consistency of a machine (Xm12-03)

- Container-filling machines are used to package a variety of liquids, including milk, soft drinks, and paint.
- Ideally, the amount of liquid should vary slightly because larger variations will cause some containers to be under-filled and some to be overfilled.
- The company has implemented a container-filling new machine and expected its variance of the fills will be less than 1.
- We have 25 samples. How can we test this assumption at the 5% significance level.

# Example 12.5 Election Day Exit Poll (Xm12-05)

- When an election for political office takes place, the TV networks cancel regular programming and instead provide election coverage.
- The networks actively compete to see which will be the first to predict a winner. This is done through exit polls wherein a random sample of voters who exit the polling booth is asked for whom they voted. From the data, the sample proportion of voters supporting the candidates is computed.
- Back to 2000 elections in Florida, the pollsters recorded only the votes of the two candidates who had any chance of winning.
- Democrat Albert Gore (code1) and Republican George Bush (Code 2). Can networks conclude from these data that the Republican candidate will win the state at 5% significance level.

# Two populations test

# Example 13.1.1 & 13.1.3 Mutual funds (Xm 13-01)

- Millions of investors buy mutual funds choosing from thousands of possibilities.
- Some funds can be purchased directly from banks or other financial institutions while others must be purchased through brokers, who charge a fee for this service.
- This raises the question, can investors do better by buying mutual funds directly than by purchasing mutual funds through brokers.
- To help answer this question a group of researchers randomly sampled the annual returns from mutual funds that can be acquired directly and mutual funds that are bought through brokers and recorded the net annual returns, which are the returns on investment after deducting all relevant fees.
- Can we conclude at the 5% significance level that directly-purchased mutual funds outperform mutual funds bought through brokers?

# Example 13.2.1 & 13.2.2 family-run business (Xm 13-02)

- What happens to the family-run business when the boss's son or daughter takes over?
- Does the business do better after the change if the new boss is the offspring of the owner or does the business do better when an outsider is made chief executive officer (CEO)?
- In pursuit of an answer researchers randomly selected 140 firms between 1994 and 2002, 30% of which passed ownership to an offspring and 70% appointed an outsider as CEO.
- For each company the researchers calculated the operating income as a proportion of assets in the year before and the year after the new CEO took over.
- The change (operating income after – operating income before) in this variable was recorded. Xm13-02
- Do these data allow us to infer that the effect of making an offspring CEO is different from the effect of hiring an outsider as CEO?

# Example 13.3 Cereals (Xm13-03)

- Despite some controversy, scientists generally agree that high-fiber cereals reduce the likelihood of various forms of cancer.
- However, one scientist claims that people who eat high-fiber cereal for breakfast will consume, on average, fewer calories for lunch than people who don't eat high-fiber cereal for breakfast.
- If this is true, high-fiber cereal manufacturers will be able to claim another advantage of eating their product--potential weight reduction for dieters.
- As a preliminary test of the claim, 150 people were randomly selected and asked what they regularly eat for breakfast and lunch.
- Each person was identified as either a consumer or a non consumer of high-fiber cereal, and the number of calories consumed at lunch was measured and recorded.
- Can the scientist conclude at the 5% significance level that his belief is correct?

# Example 13.4 Job offers (Xm13-04)

- In the last few years a number of web-based companies that offer job placement services have been created.
- The manager of one such company wanted to investigate the job offers recent MBAs were obtaining.
- In particular, she wanted to know whether finance majors were being offered higher salaries than marketing majors.
- In a preliminary study she randomly sampled 50 recently graduated MBAs half of whom majored in finance and half in marketing.
- From each she obtained the highest salary (including benefits) offer. Can we infer that finance majors obtain higher salary offers than do marketing majors among MBAs?

# Example 13.5 Comparing Salary offers for different majors (Xm13-05)

- We want to study that finance majors obtain higher salary offers than do marketing majors at 5% significance level ?
- In this example the experiment was designed in such a way that each observation in one sample is matched with an observation in the other sample. The matching is conducted by selecting finance and marketing majors with similar GPAs. Thus, it is logical to compare the salary offers for finance and marketing majors in each group.
- We randomly select a finance and a marketing major whose GPA falls between 3.92 and 4.
- We then randomly select a finance and a marketing major whose GPA falls between 3.84 and 3.92.
- We continue this process until the $25^{th}$ pair of finance and marketing majors is selected whose GPA fell between 2 and 2.08.

# Example 13.7 Testing the quality of two-bottle filling machines (Xm13-07)

- According to Example 12.3
- Suppose that we also collected data from another new machine and recorded the fills of a randomly selected sample.
- Can we infer at the 5 % significance level that the second machine is superior in its consistency

# Example 13.9 Test marketing of package design (Xm13-09)

- The GP company's advertising agency developed two new designs for soap. (design A and design B)
- As a test to determine which design is better, the marketing manager selected two supermarkets.
- In supermarket 1, the soap was packaged by using design A. In supermarket 2, the soap was packaged by using design B.
- We used scanner at each supermarket to track every buyer of soap over a 1 week period. The code for the GP brand of soap is 9077. (The other codes are 4255, 3745, 7118 and 8855).
- Do we have enough evidence to adopt design A at 5% significance level ? (Design A is more popular than design B )

# Example 13.10 Test marketing of package design (Xm13-09)

- Do we have enough evidence to conclude that design A outsell design B by more than 3% (5 %significance level) ?

# ANOVA

# Example 14.1 Proportion of total assets invested in stocks (Xm14-01)

- Internet trading has become quite common and online trades can cost as little as $7.
- It is now easier and cheaper to invest in the stock market than ever before. What are the effects of these changes?
- We randomly sampled 366 households and asked each to report the age category of the head of the household and the proportion of its financial assets that are invested in the stock market.
- We are interested about whether the ownership of stocks varied by age at 5% significance level.

# Example 14.2 Comparing the costs of repairing car bumpers (Xm14-02)

- Automobile manufactures have become more concerned with quality. One aspect of quality is the cost of repairing damage caused by accidents.

- A manufacture is considering several new types of bumpers. To test how well they react to low-speed collisions, 10 bumpers of each of four different types were installed on cars, and do low-speed collision tests.

- The cost of repairing the damage in each case was assessed. Can we infer that the bumpers differ in their reactions to low speed collisions at 5% significance level.

- If difference exist, which bumpers differ?

# Example 14.3 Four new drugs (Xm14-03)

- Many North Americans suffer from high levels of cholesterol, which can lead to heart attacks. For those with very high levels (over 280), doctors prescribe drugs to reduce cholesterol levels. A pharmaceutical company has recently developed four such drugs.

- To determine whether any differences exist in their benefits, an experiment was organized. The company selected 25 groups of four men, each of whom had cholesterol levels in excess of 280.

- In each group, the men were matched according to age and weight. The drugs were administered over a 2-month period, and the reduction in cholesterol was recorded.

- Do these results allow the company to conclude that differences exist between the four new drugs?

# Chi-squared test

# Example 15.2 Relationship between degree and major (Xm15-02)

- The MBA program was experiencing problems scheduling its courses. The demand for the program's optional course and majors was quite variable from one year to the next.

- We believed that the problem may be variability in the academic background of the students and that the undergraduate degree affects the choice of major.

- Can we conclude that the undergraduate degree has relationship with the choice of major at 5% significance level.

- The undergraduate degree:
  - BA (code =1), Beng (code =2), BBA (code =3) and other (code =4)
- MBA major:
  - Accounting (code =1), Finance (code =2), and Marketing (code =3)

# Regression

# Example 16.1-3 Cars and odometer (Xm16-02)

- Car dealers across North America use the "Red Book" to help them determine the value of used cars that their customers trade in when purchasing new cars.
- The book, which is published monthly, lists the trade-in values for all basic models of cars. It provides alternative values for each car model according to its condition and optional features.
- The values are determined on the basis of the average paid at recent used-car auctions, the source of supply for many used-car dealers. However, the Red Book does not indicate the value determined by the odometer reading, despite the fact that a critical factor for used-car buyers is how far the car has been driven.
- To examine this issue, a used-car dealer randomly selected 100 three-year old Toyota Camrys that were sold at auction during the past month.
- The dealer recorded the price ($1,000) and the number of miles (thousands) on the odometer. The dealer wants to find the regression line.

# Example 17.1 Ticket sales (Xm17-01)

- Can we create a model that will predict lift ticket sales at a ski hill based on two weather parameters?

- Variables:
- y - lift ticket sales during Christmas week,
- x1 - total snowfall (inches), and
- x2 - average temperature (degrees Fahrenheit)

- Our ski hill manager collected 20 years of data. Xm17-01