<http://www.mathsisfun.com/data/standard-normal-distribution-table.html> (Z table)

<http://www.sjsu.edu/faculty/gerstman/StatPrimer/t-table.pdf> (t table)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Critical Values (Z)** | **Level of Significance** | | | | |
| **1%** | **2%** | **4%** | **5%** | **10%** |
| Two Tailed | ±2.56 | ±2.32 | ±2.05 | ±1.96 | ±1.64 |
| Right tailed | +2.32 | +2.05 | +1.75 | +1.64 | +1.28 |
| Left tailed | -2.32 | -2.05 | -1.75 | -1.64 | -1.28 |

Q1) A cinema hall has cold drinks fountain supplying Orange and Ditzy Colas. When the machine is turned on, it fills a 550ml cup with 500ml of the required drink. The manager has three problems.

I) The clients have been complaining that the machine supplies less than 500ml

II) The manager wants to make sure that the amount of cola does not exceed 500ml

III) The manager wants to minimize customer complaint and at the same time does not want any overflow.

He takes up 36 cups of sample and finds the sample mean to be 499 ml. The specification of the machine says that generally the standard deviation is 1 ml. He does a hypothesis testing at 10% level of significance.

Q2) A tyre company wants to test the stress of tyres. The tyres should withstand a minimum load of 80,000kgs but excess load would burst the tyres. From the past experience, it is known that the standard deviation of the stress capacity is 4000kgs. A sample of 100 tyres was selected and tests were carried out. The result showed that mean stress capacity of the sample is 79,600 kgs. If the supplier uses a significance level of 5% in testing, do the tyres meet stress requirements?

Q3) A random sample of 400 flower stems has indicated that the average length of a stem is 10cm. Can this be regarded as a sample from a large population with a mean of 10.2cm and a standard deviation of 2.25cm at a significance level of 5%?

Q4) Business Today is conducting a survey between Sonepur and Muzaffarpur on the hourly wages of landless laborers. Results of the survey are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Town | Mean Hourly wage | S.D | Sample |
| Sonepur | Rs8.95 | Rs0.40 | 200 |
| Muzaffarpur | Rs9.10 | Rs0.60 | 175 |

Business Today wants to test the hypothesis at the 5% level of significance that there is no difference between hourly wages in the two towns.

Q5) The number of sales, average sales value and S.D of two sales team (one trained and the other not trained) are as follows:

|  |  |  |
| --- | --- | --- |
|  | Team A (Trained) | Team B (Not Trained) |
| Sample sales | 10 | 17 |
| Avg sales value | 6200 | 5600 |
| S.D | 690 | 600 |

At a LOS 5%, find does training actually matter for generating sales value for the concerned company?

Q6) A company is contemplating to give VRS to its employees. The HR director tells the president that roughly 60% of the employees are eligible for VRS. The president forms a special committee to assess the eligible candidates. The committee conducts in-depth interviews with 120 employees and finds that in its judgment only 70% of the people in samples are qualified for VRS. The president wants to know whether the findings of the human resource director are correct or not. (Test at a significance level of 0.05)

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Q1) The Small Grocers Association is a group of independent grocers who have banded together so that they may compete with the larger supermarket chains. By making large purchases as a group, it is able to pay less than if it were to purchase as an individual store. Because of its new-found purchasing power, the Association wants to advertise that its prices are really lower than in supermarkets. It has chosen one product (1 kg potato) with which it plans to make its point in the advertisement. But before advertising and to check on this claim, the market research team wants to test and so has obtained a random sample of prices from six Association Member Stores and nine supermarkets.

Q2) Hero Honda Ltd., as part of their operating policy, wished to determine whether there was a difference in customer satisfaction between the dealer’s customers and the company’s direct customers with respect to their warranty policies.

Q3) Toyota wanted to upgrade one of its models for the Indian market. But up gradation definitely meant a higher price charged and with stiff competition in the Indian market, Toyota, was not very sure whether the new upgraded model would impress the customers or not. So before launching the new model, the company wanted to get an idea about the prospective Indian customers. Test at 5% significance.

Q4) Lovazais a brand name prescription drug. The capsule is sold by by [GlaxoSmithKline](http://en.wikipedia.org/wiki/GlaxoSmithKline) but developed by Reliant Pharmaceuticals, which contains [fish oils](http://en.wikipedia.org/wiki/Fish_oil) and is approved by the [U.S. Food and Drug Administration](http://en.wikipedia.org/wiki/Food_and_Drug_Administration_(United_States)) to lower very high [triglyceride](http://en.wikipedia.org/wiki/Triglyceride) levels. LOVAZA, a lipid-regulating agent, and is supplied as a liquid-filled gel capsule for oral administration. Each 1-gram capsule of LOVAZA contains at least 900 mg of the ethyl esters of [omega-3 fatty acids](http://www.rxlist.com/script/main/art.asp?articlekey=13977)sourced from fish oils.

In July 2012, [Amarin Corporation](http://en.wikipedia.org/wiki/Amarin_Corporation) received U.S. FDA marketing approval for [Vascepa](http://en.wikipedia.org/wiki/Ethyl_eicosapentaenoic_acid), also referred to as AMR-101. Vascepa will undoubtedly become a major competitor for Lovaza. In clinical trials, Vascepa was shown to lower triglycerides. While Lovaza also lowers the triglyceride concentration, Vascepa also lowers LDL-Cholesterol which Lovaza does not.

The marketing department of Lovaza wanted to tackle the situation before things went out of their hand. Lovaza was approved to treat people with very high triglyceride levels (>500 mg/dl). On the other hand Vascepa demonstrated that the drug can impact levels in people with high triglyceride levels, within > 200 mg/dl and < 500 mg/dl. So knowing their gap with respect to LDL cholesterol, the team wanted to highlight their strength in reducing higher levels of triglyceride to the doctor community. But before doing so, they decided to test the level of triglyceride amongst patients who were having their drug for more than a year. The R&D department of the company claimed that on an average the triglyceride level should be around 95mg/dl for patients taking their drug.

Can you help the marketing team to carry out their testing, so that they can make their recommendations to the doctors?

Q5) The Paris climate agreement, which came up in May 2017, unites all the world's nations in a single agreement on tackling climate change for the first time in history. Coming to a consensus among nearly 200 countries for the need of environment is regarded by many observers as an achievement in itself and has been hailed as "historic". The key elements which were involved in the agreement were:

1. To keep global temperatures "well below" 2.0C (3.6F)
2. To limit the amount of greenhouse gases emitted by human activity to the same levels that trees, soil and oceans can absorb naturally
3. To review each country's contribution to cutting emissions every five years
4. For rich countries to help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy.

As always, Donald Trump, has his own way of thinking. He once notably called global warming a "hoax" perpetrated by the Chinese, and over the course of last year's campaign was largely silent on environmental issues. However, different ministries and departments have dissimilar views on the Paris agreement. Trump's working-class supporters are more concerned about jobs and their way of life, rather than the distant threat of rising sea levels or shifting climate patterns. On the other hand, his daughter, Ivanka Trump, strongly advocates for remaining in the agreement - for a range of environmental, diplomatic and national security reasons.

Now to abandon the Paris agreement to keep one large section of the supporters happy against making the international elite and US liberals angry by opting out of it is really a grave decision to make for the Trump government.

The Government decides to go along with the flow of the people of the nation at large: their decision is the government’s decision

Can you suggest a hypothesis testing model to help them out?

Q6) It was February 2, 2015 and Mr. Swami was finishing his first month as an analyst in State Bank’s online banking group. The words of his boss Raman, who had just left his office, were lingering in his mind. “There is a meeting with the senior management team to discuss our internet strategy. There is disagreement within the group on whether we should start charging fees to the use of online banking channels or we should come out with schemes which actually increase the use of the online channel”.

The debate really hinges on whether online customers are indeed valuable customers and if adoption of the online channel actually produces better customers. By better customers the company means customers who are profitable. Profitability of the customers, whether online or offline, was determined by the given formula,

(Balance in deposit accounts)\*(Net Interest spread) + (Fees) + (Interest from loans) – (Cost to serve)

Though data of 5 million customers were available, Alan though of working with a sample size of 10,000 customers of which 6,500 was offline customers. After calculating profitability using the above formula, it was found that the mean profitability of offline customers was 4300$ and that of the online customers were 4600$. However, the standard deviation for both the groups came out to be 1200$. The bank decides to charge online customers if they are less profitable and come out with schemes to increase online customers if they are more profitable.

Can you comment on the future strategy of the Pilgrim Bank regarding their online banking channel?