Problem 1

Blood glucose levels for obese patients have a mean of 100 with a standard deviation of 15. A researcher thinks that a diet high in raw cornstarch will have a positive effect on blood glucose levels. A sample of 36 patients who have tried the raw cornstarch diet have a mean glucose level of 108. Test the hypothesis that the raw cornstarch had an effect or not.

Population mean (μ) = 100

Population Standard Deviation = 15

Sample size (n) = 36

Sample mean = 108

1. State null (H0) and alternative (H1) hypothesis
   H0 : μ = 100

   H1 : μ ≠ 100

2. Choose level of Significance
   Since no Significance level was given, we will assume 5% so α = 0.05, therefore our confidence level (1 – Significance level) is 0.95 or 95%. We can say that we are 95% confident that the data is not driven by randomness

3. Find the Z score

   Z = (sample mean – population mean) / (pop std / √n)

   = (108 – 100) / (15/√36)

   = 108 – 100 / 15/6

   = 3.2

   According to the Z – Score table the probability for z – score of 3.20 is 0.9993.

   The probability of having value less than sample mean of 108 is 0.9993 and more than or equal to 108 is 1 – 0.9993 = 0.0007.

4. Since the probability of the mean glucose level more than or equal to 108 is 0.0007, which is less than the significance level of 0.05 therefore will reject the null hypothesis that there is an effect of raw cornstarch on blood glucose level.

Problem 2

In one state, 52% of the voters are Republicans, and 48% are Democrats. In a second state, 47% of the voters are Republicans, and 53% are Democrats. Suppose a simple random sample of 100 voters are surveyed from each state.
What is the probability that the survey will show a greater percentage of Republican voters in the second state than in the first state?

P1 = Proportion of Republicans voters in the first state

P2 = Proportion of Republicans voters in the second state

p1 = Proportion of Republicans voters in the sample from the first state

p2 = Proportion of Republicans voters in the sample from the second state

n1 = Number of voters sampled from the first state

n2 = Number of voters sampled from the second state

1. P1 = 0.52

   Q1 = 0.48

   P2 = 0.47

   Q2 = 0.53

2. Find the mean of the difference in sample proportions:
   E[p1 – p2] = mu = P1 – P2
   = 0.52 – 0.47
   = 0.05

3. Find the standard deviation of the difference:
   Std = $\sqrt{}$[P1(1 – P1) / n1 + [P2(1 – P2) / n1]
   = $\sqrt{}$[0.52 * 0.48 / 100] + [0.47 * 0.53 / 100]
   = $\sqrt{}$0.002496 + 0.002491
   = $\sqrt{}$0.004987
   = 0.0706

4. Find the Probability
   Z (P1 – P2) = (x – mu (P1 – P2) / std
   = 0 – 0.05 / 0.0706
   = - 0.7082
   According to the Z – Table score the probability of the z – score, -0.7082 is 0.24. Therefore, the probability that the survey will show a greater percentage of Republican voters in the second state than in the first state is 0.24.

Problem 3

You take the SAT and score 1100. The mean score for the SAT is 1026 and the standard deviation is 209. How well did you score on the test compared to the average test taker?

SAT score = X = 1100

Mean score = mu = 1026

Std = 209

Z = SAT Score – mu / std

= 1100 – 1026 / 209

= 0.354

This means my score is 0.354 standard deviations above the mean score. According to the Z – Score Table 63.68% of scores were lower than my score.

My score was within the range = mu – 209 and mu + std

= 1026 – 209 and 1026 + 209

= 817 and 1235