REPORT

Question 1)

Hypothesis

Given μ_0 = mean response time

Let H_0 = Alcohol does not affect the mean response time of pigs to a stimulus.

H_1 = Alcohol affects the mean response time of pigs to a stimulus.

Therefore, our hypothesis becomes:

$$H_0: \mu \neq \mu_0 \quad v/s \quad H_1: \mu = \mu_0$$

Here, $\mu_0 = 0.8$

Testing

We use a two-tailed t-test to test our hypothesis.

We will make our inferences using 2 ways, by test statistic and p-value

The test statistic is calculated as below:

$$T_{test} = ((sample\_mean - \mu_0) * \sqrt{n})/s \sim T(n-1)$$

where n = sample size and s = standard deviation

From this, we get our p-value as:

$$P(T > |t|) = 2*P(T > t)$$

Results

Below is output of our code:

Test statistic: 3.527668

Test Critical Value: 2.051831

P value: 0.001521206

Inference

As we can see, test statistic value lies in the rejection region(as inferred from critical value)

Also, our p-value < $\alpha = 0.05$. Thus, we reject H_0 or, Alcohol does affect the mean response time of pigs to a stimulus.

Question 2)

Hypothesis

Given σ_0 = standard deviation of the drug

Let H_0 = New method will not be adopted to produce drugs.

H_1 = New method will be adopted to produce drugs.

Therefore, our hypothesis becomes:

$$H_0: \sigma \geq \sigma_0 \quad v/s \quad H_1: \sigma < \sigma_0$$

Testing

We use a one-sided chi square test to test our hypothesis.

We will make our inferences using 2 ways, by test statistic and p-value

The test statistic is calculated as below:

$$\chi_{test} = ((n-1)*\sigma^2)/(\sigma_0)^2 \sim (\chi_{n-1})^2$$

where n = sample size and σ = standard deviation

From this, we get our p-value as:

$$P(\chi_{n-1} \geq t)$$

Results

Below is output of our code:

Test statistic: 0.000925

Test Critical Value: 3.325113

P value: 1.879238e-17

Inference

As we can see, test statistic value does lie in the rejection region(as inferred from critical value)

Also, our p-value < $\alpha = 0.05$. Thus, we reject H_0 or, new method will be adopted to produce drugs.

Question 3)

Hypothesis

Given μ_0 = mean response time

Let H_0 = mean blood pressures of smokers and nonsmokers are same.

H_1 = mean blood pressures of smokers and nonsmokers are not same.

Therefore, our hypothesis becomes:

$$H_0: \mu_1 = \mu_2 \quad v/s \quad H_1: \mu_1 \neq \mu_2$$

Testing

Both s.d's are unknown so we use a two-tailed t-test to test our hypothesis.

We will make our inferences using 2 ways, by test statistic and p-value

The test statistic is calculated as below:

$$T_{test} = ((sample\_mean\_1 - sample\_mean\_2) - (\mu_1 - \mu_0))/\sqrt{(s_1^2/n_1 + s_2^2/n_2)}$$

where s_1 = standard deviation of BP of smokers, s_2 = standard deviation of BP of non-smokers, n_1 = sample size of smokers, n_2 = sample size of non-smokers, sample_mean_1 = mean of BP of smokers, sample_mean_2 = mean of BP of non-smokers

From this, we get our p-value as:

$$P(T > |t|) = 2*P(T > t)$$

Results

Below is output of our code:

Test statistic: 2.523931

Test Critical Value: 2.075898

P value: 0.01946976

Inference

As we can see, test statistic value lies in the rejection region(as inferred from critical value)

Also, our p-value < $\alpha = 0.05$. Thus, we reject H_0 or, mean blood pressures of smokers and nonsmokers are not same.