Q.No.1: - (5 points).
Suppose that the starting salary (in $1000) for this year's graduates at a Brock University (BU) has a probability density function

\[ f(x) = \begin{cases} \frac{x}{4}, & 1 < x < 3 \\ 0, & \text{otherwise} \end{cases} \]

Any fresh graduate from Brock University having a salary more than $2500 is considered to have a high salary. Find the probability that a randomly selected graduate from this year’s graduates of BU has a high salary.

Q.No.2: - (5 points).
It is assumed that the time to failure of an electronic component is exponentially distributed with a mean of 50 hours. What is the probability that a randomly selected component will fail within 40 hours?
Q.No.3: (5 points).
A company manufactures tube light rods for household use. The length of the tube rods (in meters) is assumed to follow $N(\mu = 1, \sigma^2 = 0.01^2)$. Any manufactured tube rod is declared defective if its length is less than 0.98 m or greater than 1.02 m. If a random sample of size 10 rods is selected, what is the probability that the mean length is less than 1.01 meter?

Q.No.4: (5 points).
A random sample of 50 suspension helmets used by motorcycle riders and automobile race-car drivers was subjected to an impact test, and on 18 of these helmets some damage was observed. Using the point estimate of $p$ obtained from the preliminary sample of 50 helmets, how many helmets must be tested to be 95% confident that the error in estimating the true value of $p$ is less than 0.02?
A jam producer claims that the mean weight of jam in a jar is exactly 230 grams. A random sample of 8 jars is selected and the weight of jam in each jar is determined. The average weight of these 8 jars is 225.25. Assume that the weight of jam in a jar is normally distributed with a standard deviation of 4 grams. Using a 0.05 significance level, test the claim of jam producer.

1) Hypothesis

H0: 

H1: 

2) Level of significance: 

3) Summary of available information: 

4) Test

Formula of the test: 

Value of the test statistic: 

5) a) p-value approach

P-value: 

b) Critical value or rejection region Approach

RR: 
6) Decision (with justification):
   
a) Using p-value approach: 
   
   b) Using RR approach: 

7) Conclusion: 

8) 95% confidence interval for the mean weight of jam:
\[ \mu = E(X) = \int_{-\infty}^{\infty} x f(x) \, dx; \quad E(X^2) = \int_{-\infty}^{\infty} x^2 f(x) \, dx \quad \text{and} \quad \sigma^2 = E(X^2) - \mu^2 \]

Exponential Dist: 
\[ f(x) = \left(\frac{1}{\beta}\right) e^{-x/\beta}; \quad x > 0; \quad \mu = \beta; \quad \sigma = \beta; \quad F(x) = 1 - e^{-x/\beta} \]

Standard Normal Transformations: 
\[ Z = \frac{X - \mu}{\sigma}; \quad Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}; \quad Z = \frac{p - \pi}{\sqrt{\pi(1-\pi)n}} \]

<table>
<thead>
<tr>
<th>Confidence Interval</th>
<th>Test Statistic</th>
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</thead>
<tbody>
<tr>
<td>( \bar{x} \pm Z_{\frac{a}{2}} \frac{\sigma}{\sqrt{n}} ) and ( n \geq \left( \frac{\sigma Z_{\frac{a}{2}}}{e} \right)^2 )</td>
<td>( Z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} )</td>
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<tr>
<td>( \bar{x} \pm t_{\frac{a}{2}, n-1} \frac{s}{\sqrt{n}} )</td>
<td>( T = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} )</td>
</tr>
<tr>
<td>( \hat{p} \pm Z_{\frac{a}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} ) and ( n \geq \frac{Z_{\frac{a}{2}}^2 [\hat{p}(1-\hat{p})]}{e^2} )</td>
<td>( Z = \frac{\hat{p} - p_0}{\frac{p_0(1-p_0)}{n}} )</td>
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