Q1: (24 points). Encircle the correct option for the following MCQs.

1: The distribution for the number of emergency calls to a city’s 911 emergency number in a one-hour time period is likely to be described by a
   A. Poisson distribution
   B. binomial distribution
   C. Hypergeometric distribution
   D. Uniform distribution

2: If a random variable $X$ has a Poisson distribution with parameter $\lambda = 4$, then $E(X^2) =$
   A. 4
   B. 14
   C. 20
   D. 0.2

3: The average score of 10 students in an exam is 52. The instructor discovers that he entered one score by mistake as 40 instead of 20. He updated his record and found the new average equals to:
   A. 48
   B. 52
   C. 50
   D. 42

4: Suppose that we want to estimate the true proportion of defectives in a very large shipment of adobe bricks. And that we want to be at least 95% confident that the error is at most 4%. How large the sample will be needed?
   A. 93
   B. 2401
   C. 601
   D. 218

5: The probability that a regularly scheduled flight departs on time is 0.83; the probability that it arrives on time is 0.82; of those departed on time, 0.94 arrives on time. What is the probability that a plane departs on time and arrives late?
   A. 0.7802
   B. 0.7708
   C. 0.0498
   D. 0.0592

6: The time that a technician requires to perform preventive maintenance on air conditioning unit is governed by a distribution with mean time one hour and variance also one. Your company has a contract to maintain 70 of these units in an apartment building. What is the probability that their average maintenance time exceeds 75 minutes?
   A. 0.0183
   B. 0.9817
   C. 0.7135
   D. 0.2865
7: The weekly sales from a sample of 10 computer stores yielded a mean of $25,900; a median of $25,000 and a mode of $24,400. Then the shape of the data is:

A. Skewed to the left  
B. Skewed to the right  
C. Symmetric  
D. Can’t be determined

8: A random sample is drawn from a population with a known standard deviation of 2.0. What sample size would give a standard error equal to 0.5?

A. 4  
B. 16  
C. 1  
D. 0

9. Which of the following descriptive statistics is least affected by outliers?

A. Mean  
B. Median  
C. Range  
D. Standard deviation

10: An economist is interested in studying the incomes of consumers in a particular country. The population standard deviation is known to be $1,000. A random sample of 50 individuals resulted in a mean income of $15,000. What is the upper end point in a 99% confidence interval for the average income?

A. $15,052  
B. $15,364  
C. $15,330  
D. $15,141

11: The z value needed to construct 92.5% confidence interval estimate for the difference between two population proportions is

A. 2.58  
B. 2.33  
C. 1.96  
D. 1.78

Q12: Which of the following is not a condition of the binomial distribution?

A. The standard deviation is equal to the square root of the mean  
B. Two possible outcomes for each trial  
C. The trials are independent  
D. The probability of a success remains constant from trial to trial
Q.No.2: - (16 points).

The tensile strength of a paper product is related to the amount of hardwood in the pulp. Ten samples are produced in the pilot plant, and the data obtained are shown in the following table.

<table>
<thead>
<tr>
<th>Strength</th>
<th>160</th>
<th>171</th>
<th>175</th>
<th>182</th>
<th>184</th>
<th>181</th>
<th>188</th>
<th>193</th>
<th>195</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>10</td>
<td>15</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>25</td>
<td>28</td>
<td>30</td>
</tr>
</tbody>
</table>

Using MINITAB we analyzed the data and got the output below.

**Regression Analysis: Strength versus Hardwood**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coef</th>
<th>SE Coef</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>143.824</td>
<td>2.522</td>
<td>57.04</td>
<td>0.000</td>
</tr>
<tr>
<td>Hardwood</td>
<td>1.8786</td>
<td>0.1165</td>
<td>16.12</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Analysis of Variance**

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>1262.1</td>
<td>1262.1</td>
<td>260.00</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual Error</td>
<td>8</td>
<td>38.8</td>
<td>4.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of Fit</td>
<td>4</td>
<td>13.7</td>
<td>3.4</td>
<td>0.54</td>
<td>0.716</td>
</tr>
<tr>
<td>Pure Error</td>
<td>4</td>
<td>25.2</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>1300.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Predicted Values for New Observations**

<table>
<thead>
<tr>
<th>New Obs</th>
<th>Fit</th>
<th>SE Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>185.154</td>
<td>0.711</td>
</tr>
</tbody>
</table>

**Values of Predictors for New Observations**

<table>
<thead>
<tr>
<th>Percent</th>
<th>New Obs</th>
<th>Hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.0</td>
<td></td>
</tr>
</tbody>
</table>

Using the above output to answer the following questions.

(a) Write the estimated linear regression model relating strength to percent hardwood.

(b) What is the estimated value of the tensile strength when the percentage amount of hardwood is 22.
(c). Compute coefficient of determination and interpret it.

(d). What change in mean tensile strength of the paper product would be expected for a 1% change in the amount of hardwood in the pulp?

(e) What is the value for error variance?

(e). At 5% level of significance, test that the higher the percentage amount of hardwood, the larger the tensile strength of a paper product.

(f). Find a 95 percent confidence interval on the parameter $\beta_1$ (the slope coefficient).

(g). Estimate the mean tensile strength of the paper when the percentage amount of hardwood in the pulp is 22, using 95% confidence level.
Q3: (4 points) A major cell phone service provider has determined that the number of minutes that its customers use their phone per month is normally distributed with a mean equal to 445.5 minutes with a standard deviation equal to 177.8 minutes. The company is thinking of charging a lower rate for customers who use the phone less than a specified amount. If they wish to give the rate reduction to no more than 12 percent of their customers, what should the cut-off be?

Q4: (4 points) A major retail clothing store is interested in estimating the difference in mean monthly purchases by customers who use the store’s in-house credit card versus using a Visa, Mastercard, or one of the other major credit cards. To do this, they have randomly selected a sample of customers who have made one or more purchases with each of the types of credit cards. The following represents the results of the sampling:

<table>
<thead>
<tr>
<th></th>
<th>In-House Credit Card</th>
<th>National Credit Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size:</td>
<td>86</td>
<td>113</td>
</tr>
<tr>
<td>Mean Monthly Purchases:</td>
<td>$45.67</td>
<td>$39.87</td>
</tr>
<tr>
<td>Standard Deviation:</td>
<td>$10.90</td>
<td>$12.47</td>
</tr>
</tbody>
</table>

Based on these sample data, what is the lower limit for the 95 percent confidence interval estimate for the difference between population means?
Q.No.5: - (7 points).

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) p-value approach
   
   P-value: ________________________________
   
   ________________________________
   
   ________________________________

6) Decision (with justification):

   ________________________________
   
   ________________________________

7) Conclusion: ________________________________
   
   ________________________________