

**Q3 (5 marks): Binomial distribution**

A machine produces 2000 cells per hour, and 6 percent of all cells produced can't pass a QC exam. What is the probability of having only 1 cell that pass audit in a randomly selected sample of 20 cells?

**Response Q3**

**Q5 (5 marks): Geometric distribution**

The probability for finding an error by an auditor in a production line is 0.3.

5.1) What is the probability that the first error is found at the 40<sup>th</sup> part audited?

5.2) What is the probability that more than 50 parts must be audited before the first error is found?

**Response Q5**

**Q4 (5 marks): Poisson distribution**

A product failure has historically averaged 2.7 occurrences per week.

- 4.1. What is the probability of 1 failures in a randomly selected week?
- 4.2. Represent the probability distribution ( $x$  from 1 to 3).

**Response Q 4**

**Note:**

- The sample mean:  $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$

- The range: Range =  $x_{\text{maximum}} - x_{\text{minimum}}$

- Sample Standard deviation:  $s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

- Sample Variance:  $s^2$

- Coefficient of variation:  $CV = \left( \frac{s}{\bar{x}} \right) \cdot 100\%$

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**Binomial distribution:**

$$P(X) = \frac{n!}{(n-X)! X!} \cdot (p)^X \cdot (q)^{n-X}$$

**Poisson distribution:**

$$P(X) = (e^{-\mu}) (\mu^X) / X!$$

**Geometric distribution:**

$$P(X = k) = q^{(k-1)} p, \text{ where } q = 1 - p$$

$$P(X > k) = q^k$$

$$E(X) = 1/p$$

$$\text{Var}(X) = q/p^2$$

## **Q2 (5 marks)**

Let  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ,  $A = \{2, 4, 6, 8, 10\}$ ,  $B = \{1, 3, 5, 7, 9\}$ ,  $C = \{1, 2, 5, 8, 10\}$ .

List the elements of the sets corresponding to the following events:

- 2.1)  $A \cap B$**
- 2.2)  $A \cup B$**
- 2.3)  $A \cap C$**
- 2.4)  $P(A \cap C)$**
- 2.5)  $P(A \cap B)$**
- 2.6)  $P(A|C)$**

**Q1 (10 marks)**

In a manufacturing process data were gathered for the weight of a car part. The data are:

10	11	11	8	9	10	12	11	12	10	9
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- 1.1) Determine the sample central tendency measures (mean, median and the mode).
- 1.2) Determine the sample variability measures (standard deviation, the variance, the range and the coefficient of variation).
- 1.3) Plot the dot plot of the process data
- 1.4) If the design specification is  $W = (10 \pm 2)$  gram, give your comments on the quality of the product.

**Response Q1**