Chapter 04 – Computer Science (Class 10)
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Extended Response Questions

Question No 1: Analyse the interrelationship between Data Science, Machine Learning, and Artificial Intelligence.

Answer: Data Science, Machine Learning (ML), and Artificial Intelligence (AI) are closely connected fields that work together to solve problems using data and computers.

Data Science is the broad field that involves collecting, cleaning, and analyzing large amounts of data to find useful information and make decisions. It focuses on understanding data and extracting knowledge from it.

Machine Learning is a part of AI that uses data to teach computers how to learn and improve from experience without being explicitly programmed. It depends heavily on data collected and prepared by data science. ML uses algorithms to find patterns in data and make predictions or decisions.

Artificial Intelligence is the bigger idea of creating smart machines that can perform tasks that normally require human intelligence, like recognizing speech, understanding images, or making decisions. AI includes many techniques, and machine learning is one of the main ways AI systems learn and improve automatically.

In simple terms, data science provides the data and tools needed, machine learning uses this data to learn and create models, and artificial intelligence applies these models to perform intelligent tasks. Without data science, machine learning would not have good data to learn from, and without machine learning, AI systems would not be able to improve or adapt on their own.

Question No 2. Identify any three types of data visualization, give their applications as well.

Answer:

1. **Bar Chart**
   A bar chart uses rectangular bars to show comparisons between different categories. It is useful for comparing sales of different products or showing survey results.
   Application: Businesses use bar charts to compare monthly sales of different products.
2. **Pie Chart**
   A pie chart shows data as parts of a whole, divided into slices. It helps to understand the percentage or proportion of each category.
   Application: Companies use pie charts to show market share of different brands.
3. **Line Graph**
   A line graph connects points to show trends or changes over time. It helps track progress or patterns.

Application: Meteorologists use line graphs to display temperature changes over days or months.

Question No 3. Discuss the way data visualization can be used to communicate data uncertainty, provide two specific examples.

Answer: Data visualization can show not only the data but also how certain or uncertain that data is. This helps people understand the limits or possible errors in the information. Visual tools like error bars, shaded areas, or confidence intervals can represent uncertainty clearly.

Example 1: In a weather forecast graph, shaded areas around the temperature line can show the range of possible temperatures, telling us the forecast might vary within that range. This helps people prepare for different weather conditions.
Example 2: In a medical study chart, error bars on a bar graph can show the possible variation in treatment results, indicating how much the results might change if the study is repeated. This helps doctors understand how reliable the results are.

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4. Describe the key considerations in selecting appropriate visualizations for different types of data and analyses.

Answer: When choosing the right visualization, it's important to think about the kind of data you have and the story you want to tell. First, consider whether the data is categorical (like names or types) or numerical (like numbers or measurements). For comparing categories, bar charts or pie charts work well. For showing changes over time, line graphs are better.

Next, think about the audience and what you want them to understand. Simple charts are best for easy understanding, while more detailed visuals are useful for experts. Also, consider if you need to show relationships, distributions, or trends, and pick charts that highlight those clearly. Finally, keep the design clear and avoid clutter so the message is easy to read.

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5. Explain the uses of data visualization in detail:

Answer: Data visualization means showing data in the form of pictures like **charts, graphs, and maps**. It helps people understand data easily. Here are some important uses:

1. **Easy to Understand:**
   It is hard to understand large tables of numbers. But with graphs and charts, we can see patterns and trends quickly.
2. **Find Patterns and Trends:**
   Data visualization helps us see how things change over time. For example, a line graph can show how sales increased or decreased in a year.

3. **Spot Mistakes:**
   Sometimes, wrong data can be seen clearly in a graph. For example, if one bar in a bar chart is much higher than expected, we can check if it's an error.
4. **Compare Data:**
   We can compare two or more things easily. For example, comparing marks of students in different subjects using a bar chart.
5. **Better Decision Making:**
   When data is easy to understand, people can make better and faster decisions. Businesses, teachers, or even students can use this to improve results.
6. **Sharing Information:**
   Charts and graphs help explain data to others clearly, even if they are not experts.

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6. What are the potential consequences of poor data quality on model performance?

Answer: Poor data quality means the data has **mistakes, missing values, or wrong information**. This can seriously affect how a model works. Here are the consequences:

1. **Incorrect Results:**
   If the data is wrong, the model will also give wrong answers or predictions.
2. **Low Accuracy:**
   The model will not perform well. It may make many mistakes and give poor results.
3. **Wasted Time and Resources:**
   A lot of time is spent on training the model. If the data is bad, all that time and effort is wasted.
4. **Bad Decisions:**
   Wrong predictions can lead to wrong decisions. For example, a business may lose money because of a wrong forecast.
5. **Loss of Trust:**
   If the model keeps giving wrong answers, people will stop trusting it.
6. **Extra Work Needed:**
   Poor quality data needs a lot of cleaning and fixing before it can be used, which takes more time.

The End

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