Course Title:	Artificial Intelligence	Course Code:	CSC462	Credit Hours:	3
Course Instructor	Dr. Atifa Athar, Dr. Zeeshan Gilani, Ms. Khaula Qadeer	Programme Name:	BS(CS), BS(SE)		
Time Allowed:	180 mins	**Maximum Marks:**		**50**	
Name & Registration No					

Question No 1. Marks: 5+5 =10

CLO: <1>; Bloom Taxonomy Level: <Understanding>

A magnitude 7.8 earthquake strikes a densely populated urban area. Several buildings have collapsed, roads are blocked by debris, and communication networks are disrupted. Rescue teams struggle to navigate the disaster zone and locate survivors trapped under rubble. A Disaster Response Drone (DRD) agent is deployed to assist rescue operations by locating survivors, assessing damage, and providing real-time information to ground teams. Within minutes of the earthquake, a DRD agent is launched to survey the affected area. It prioritizes regions with the highest population density and visible damage. It also transmits live video feeds and thermal scans to the command center. Rescue teams receive detailed maps of survivor locations and structural risks. The DRD also delivers emergency supplies to unreachable areas while larger-scale relief efforts are organized. After immediate rescue efforts, the DRD agent gathers data for damage assessment and reconstruction planning.

a. List down at least five sensors, you will select for designing the DRD agent.
b. Identify at least five utility functions for such DRD agents.

Question No 2. Marks: 10 (4+4+2)

CLO: <2>; Bloom Taxonomy Level: <Applying>

Consider the following tree-like graph. Suppose that the top level is the MAX node. Utilize the Mini-Max algorithm with Alpha-Beta pruning to determine what action A should take and the associated utility; in which direction should the player move from A (B or C) and why? Also, mention which tree node will be pruned using Alpha-Beta pruning.
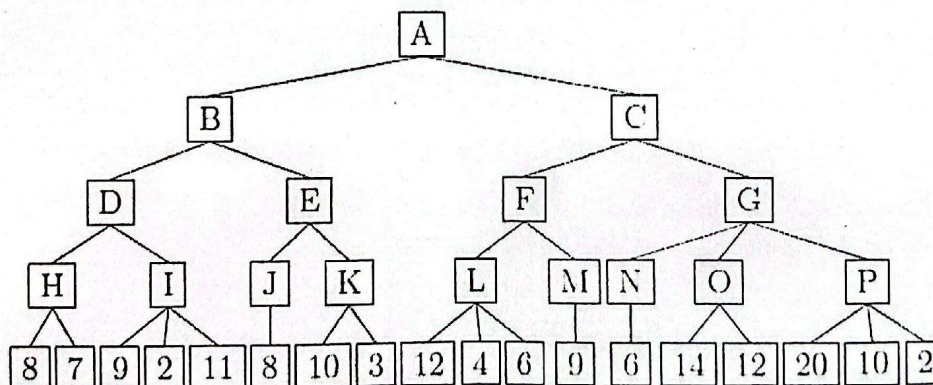
Question No 3. Marks: 10

CLO: <3>; Bloom Taxonomy Level: <Applying>

Consider the following cryptarithmetic puzzle: Apply Constraint Satisfaction to this puzzle to provide the solution. Show all steps and calculations.

1. Use only the digits from 0 – 9.
2. No leading zeros.
3. Each letter maps to only one number.

```
      F  L  U
  +   F  L  U  E
  +   F  L  E  W
  -----------------
      S  P  E  L  L
```

Hint: L = 7

Question No 4.   Marks: 10

CLO: <4>; Bloom Taxonomy Level: <Applying>

Construct a conceptual graph for the following statements

Aleena is a sister of Ahmed. They live in Johar Town Block B which is before Block C. They both own their cars. Aleena owns a Blue Toyota GLI number LHR-4345. Ahmed owns Golden Honda City number LAE-4345. Both decided to go on a vacation to Hunza for a week. They carried the luggage in Aleena's Toyota car and Grocery in Ahmed's Honda City car. The cost of the trip was two Hundred thousand rupees. They decided to stay in a hotel between a hill and a river. The vase fell on the carpet but did not break in the hotel room. Aleena believes that Ahmed likes to drive. In reality, Ahmed got tired due to the long drive.

Question No 5.   Marks: 10

CLO: <5>; Bloom Taxonomy Level: <Analyzing>

A company wants to classify emails as **Spam** or **Not Spam** based on the occurrence of specific words in the email content. You are given the following dataset:

Email ID	Word: "Offer"	Word: "Free"	Word: "Urgent"	Spam/Not Spam
1	Yes	Yes	No	Spam
2	Yes	No	Yes	Spam
3	No	No	Yes	Not Spam
4	No	Yes	No	Not Spam
5	Yes	Yes	Yes	Spam

(i) Compute the prior probabilities for **Spam** and **Not Spam**.

(ii) Compute the conditional probabilities for each word (e.g., P(Offer = Yes | Spam), P(Free = Yes | Not Spam)).

(iii) Given a new email with the features:

- **Offer = Yes, Free = No, Urgent = No**
  Use the Naive Bayes classifier to determine whether this email is classified as **Spam** or **Not Spam**.