END SEM Rubric

Q)-What is the approximate no. of ingredients present in the world? **(1marks**)
A)10^50
B)10^40
C)10^30
D)10^10
Solution C

Q)Consider the following statements - **(1marks)**
Deep Learning models require manual feature selection
RNN models can store information about previous input

Now choose the correct option -
A is true and B is false
A is false and B is true
Both A and B are true
Both A and B are false
Solution - B

Q) How can frames and scripts be used together in an online shopping application to enhance knowledge representation and user experience? **(2marks)**
Solution-Frames can be employed to represent product information, including attributes such as "category," "brand," "price," "description," and "customer reviews." Each frame instance would correspond to a specific product, containing attribute values specific to that product. For example, a frame instance for a smartphone may have attribute values like category: electronics, brand: Apple, price: $999, description: "5.8-inch display, 12MP camera," and customer reviews: 4.5 stars.
Scripts, on the other hand, can capture sequences of events or actions related to online shopping. These scripts can represent processes like "adding items to the cart," "proceeding to checkout," "entering shipping details," and "making payment." Each script outlines the step-by-step actions required to complete a specific task.
By combining frames and scripts, the online shopping application can provide a more comprehensive and interactive experience for users. For instance, when a user searches for a specific product, the application can retrieve the relevant frame instance and display the corresponding attributes to the user. The scripts can guide the user through the purchasing process, providing clear instructions and options at each step.

Q) What is generative grammar of cooking? Provide any 4 computation gastronomy resources and explain the motive or purpose behind each resource(each 1-2 line)? **(1marks)**

Solution- 1 marks for both parts

Q) Imagine a scenario where you have an autonomous car driving on a busy city street. The car needs to detect and track nearby vehicles, pedestrians, and other potential obstacles to ensure safe navigation. Which type of sensing, active or passive, would be more suitable for this situation: active or passive sensing?(1 marks)

Solution-In this case, considering the requirement of detecting and tracking objects in a noisy and complex environment like a city street, the more suitable choice would be active sensing. Active sensing involves emitting signals and measuring their reflections, providing more detailed and accurate information.

One example of active sensing that is commonly used in autonomous vehicles is LiDAR (Light Detection and Ranging). LiDAR systems emit laser beams and measure the reflections to create a detailed 3D map of the surrounding environment. By actively emitting signals and accurately measuring their reflections, LiDAR can provide precise information about the position, distance, and shape of nearby vehicles, pedestrians, and obstacles.

Passive sensing, on the other hand, relies on external sources of energy or signals without emitting any signals itself. While passive sensors like cameras can provide visual information about the environment, they may be less reliable in busy and complex scenarios due to factors like lighting conditions, occlusions, and limited field of view.

Therefore, in the context of an autonomous car navigating a busy city street and requiring accurate detection and tracking of objects, active sensing, particularly LiDAR, would be the more suitable choice.

Q) Given:

If a person is over 18 years old, they are eligible to vote.

John is eligible to vote.

If a person is not eligible to vote, they cannot participate in the election.

Mary is participating in the election.

Question:Based on the given information, can we conclude whether Mary is over 18 years old or not? Explain using inference rules**. [2 Marks]**

Solution:

To determine whether Mary is over 18 years old or not, we can use a combination of Modus Ponens and Modus Tollens.

Using Modus Ponens, we can infer that since John is eligible to vote (premise 2) and being eligible to vote implies being over 18 years old (premise 1), John must be over 18 years old. Now, using Modus Tollens, we can infer that since Mary is participating in the election (premise 4) and participating in the election implies being eligible to vote (premise 3), Mary must be eligible to vote.

Combining the information from the inference steps, we can conclude that Mary is eligible to vote. However, this does not guarantee if Mary is over 18 years old. Thus, we cannot conclude that Mary is over 18 years.

Q. : Examine the short Prolog program below and answer the questions.
(i) Explain in words what the following Prolog program does.
(ii) Show its output with some values for all its arguments.
(iii) Where all does backtracking occur? Where all does recursion occur? **[3 marks]**

```
oc(_, [], 0).
oc(X, [Y|L], N) :- not(X=Y), oc(X, L, N).
oc(X, [X|L], N) :- oc(X, L, M), N is M+1.
```

Solution: (i) The Prolog program finds if an element X occurs N times in a given list L. If X occurs in List L N times then the program succeeds and returns True, else False.
(ii) ?-oc(3, [2, 3, 3, 4, 5, 6], 2). Returns true. ?-oc(3, [2, 3, 4, 4, 5, 6], 2). Returns false.
(iii) Backtracking occurs in the second clause where not(X=Y) is checked wherein if the check fails, that is X=Y then it backtracks and goes to the next clause to count how many times that element has occurred. Recursion occurs in clause 2 and clause 3 when the program goes to check in the tail of the list.

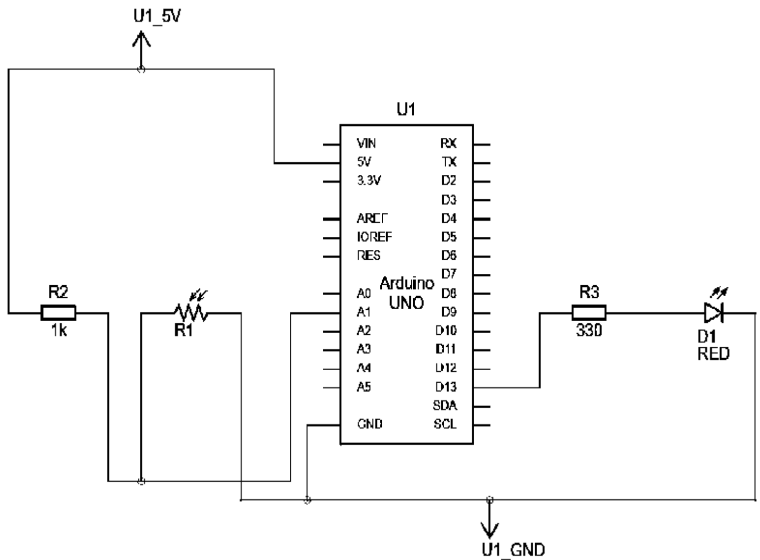
Q) Consider the following circuit implemented using an arduino to turn on an LED during night. We have used a Photoresistor to measure the intensity of ambient light, and this is recorded via pin A1 (analog input). The values received at Pin A1 range from 0-1023 representing the intensity of the ambient light. In this setup, the value read at A1 is inversely proportional to the light intensity falling on the photoresistor. Using this sensor data read through pin A1, we want to turn on an LED during night (when the intensity at A1 crosses some threshold). **[2 marks]**

Now complete the loop() function of an arduino program in the code given below -

```
// C++ code
void setup()
{
  pinMode(13, OUTPUT); // LED is connected to pin 13
  // No need to initialize pin A1 as Analog pins are
  // always for input
}

void loop()
{
 // start code here
 // read the values at A1 using AnalogRead(A1)
 // and turn the LED on/off accordingly


 // end code here
  delay(1000); // Wait for 1000 millisecond(s)
}
```



Solution -

```
// C++ code
void setup()
{
  pinMode(13, OUTPUT); // LED is connected to pin 13
  // No need to initialize pin A1 as Analog pins are
  // always for input
}

void loop()
{
 // start code here
 // read the values at A1 using AnalogRead(A1)
 // and turn the LED on/off accordingly

  int darkness = analogRead(A1);
  if (darkness > 512)
          digitalWrite(13,HIGH);
   else digitalWrite(13,LOW);

 // end code here
  delay(1000); // Wait for 1000 millisecond(s)
}
```

Q) Out of 1000 images classified as dog images using a machine learning model, 900 were correctly predicted as dogs (true positives), 10 were incorrectly classified as cats (false negatives), 80 images were correctly predicted as cats (true negatives), and 10 were incorrectly classified as dogs (false positives). Now find the accuracy, precision and recall of the classification model. **[2 marks]**

Solution -

Precision = TP / (TP + FP) = 900 / (900 + 10) = 900 / 910 ≈ 0.989 (or 98.9%)

Recall = TP / (TP + FN) = 900 / (900 + 10) = 900 / 910 ≈ 0.989 (or 98.9%)

Accuracy = (TP + TN) / (TP + TN + FP + FN) = (900 + 80) / (900 + 80 + 10 + 10) = 98%

Q) Using the techniques you have learned in the course, design an intelligent system for pandemic prediction, such as predicting the occurrence of a COVID-like pandemic. Assess the system based on the following rubric, considering the components discussed in class: **[5 marks]**

1. Input Interface (1 mark):

How effectively does the system allow users or other systems to input relevant data for pandemic prediction?
Does it provide a user-friendly and intuitive interface for data input?

2. Knowledge Base (1 mark):

How well does the system store and organize the required knowledge or information for pandemic prediction?
Does it incorporate a diverse range of data sources and update the knowledge base regularly?

3. Inference Engine (2 marks):

How effectively does the system utilize the knowledge base to reason and make decisions about pandemic occurrence?
Does it employ reasoning, logic, and inference techniques discussed in class to draw accurate predictions?
How well does it handle uncertain or incomplete data in the prediction process?

4. Output Interface (1 mark):

How effectively does the system present the results or decisions regarding pandemic prediction?
Does it provide clear and concise outputs that are easily understandable to users or other systems?

Does it offer visualizations or additional information to support decision-making based on the predictions?
Please provide a detailed explanation and justification for each component in your assessment, considering the techniques and concepts learned throughout the course.
Solution- Based on the correct explanation.

Q) Consider a vision system for an automated vehicle driving on a freeway. Discuss the tasks faced by the driver. **(2 marks)**
Solution- Based on the correct explanation.

Q) Consider a mobile robot moving on a horizontal surface. Suppose that the robot can execute two kinds of motions: **(2 marks)**

- Rolling forward a specified distance.
- Rotating in place through a specified angle.

The state of such a robot can be characterized in terms of three parameters (r, y, Q, the x-coordinate and y-coordinate of the robot (more precisely, of its center of rotation) and the robot's orientation expressed as the angle from the positive × direction. The action " Roll (D)"
has the effect of changing state $(x, y, \theta$ to $(x + D\cos(\theta), y + D\sin(\theta), \theta)$, and the action Rotate (Φ) has the effect of changing state (X, y, θ) to $(x, y, \theta + \Phi)$.

A. Suppose that the robot is initially at (0, 0, 0) and then executes the actions Rotate (60°), Roll (1), Rotate (25°), Roll (2). What is the final state of the robot?

B. Now suppose that the robot has imperfect control of its own rotation, and that, if it attempts to rotate by O, it may actually rotate by any angle between Φ - 10° and Φ + 10°.

In that case, if the robot attempts to carry out the sequence of actions in (A), there is a range of possible ending states. What are the minimal and maximal values of the ×-coordinate, the y-coordinate and the orientation in the final state?

Found Errors in Solution? >> Report here!

Answer

Answer: Option 2 (1 + √2, 4 + √2, 90°)

Reason: Initial position of robot is (1, 3, 30°)

When the robot executes first action, ROTATE(15°), the position becomes (1, 3, 30+15) = (1, 3, 45°)

After second action, ROLL(2), the position becomes (1 + 2cos45°, 3 + 2sin45°, 45°) = (1 + √2, 3 + √2, 45°)

After third action, ROTATE(45°), the position becomes (1 + √2, 3 + √2, 45 + 45) = (1 + √2, 3 + √2, 90°)

After fourth action, ROLL(1), the position becomes (1+ √2 + 1cos90°, 3 + √2 + 1sin90°, 90°) = (1 + √2, 4 + √2, 90°)

So,(1 + √2, 4 + √2, 90°) becomes the final state of the robot.

A. Let's calculate the final state of the robot after executing the given sequence of actions:
Initial state: $(x, y, \Phi) = (0, 0, 0)$

1. Rotate (60°): This action changes the state to (x, y, Φ + 60°) = (0, 0, 60°)
2. Roll (1): This action changes the state to (x + 1 * cos(60°), y + 1 * sin(60°), Φ + 60°) = (0.5, √3/2, 60°)
3. Rotate (25°): This action changes the state to (x, y, Φ + 25°) = (0.5, √3/2, 85°)
4. Roll (2): This action changes the state to (x + 2 * cos(85°), y + 2 * sin(85°), Φ + 85°) = (0.5 + 2 * cos(85°), √3/2 + 2 * sin(85°), 85°)

Calculating the numerical values: x ≈ 0.5 + 2 * cos(85°) ≈ 0.674 and y ≈ √3/2 + 2 * sin(85°) ≈ 2.858 and Φ ≈ 85°
Therefore, the final state of the robot is approximately (0.674, 2.858 85°).
B)
(Xmax,Ymin)-->(cos(50deg.)+2cos(65deg.),sin(50deg)+2sin(65deg.),65deg.)
(Xmin,Ymax)-->(cos70deg)+2cos(105deg),sin(70)+2sin(105),105deg)