**COMP 3710 Artificial Intelligence**

Fall 2018

Term test II

Student Name: Student Number:

1. (3 marks) There are two rules for carnivores in the ZooKeeper problem.

* If *X* is a mammal and *X* eats meat, then *X* is a carnivore.
* If *X* is a mammal and *X* has pointed teeth and *X* has claws and *X* has forward pointing eyes, then *X* is a carnivore.

1. Decide propositional symbols for the above rules.
2. Convert the above two rules to Horn forms with the above propositional symbols in a).
3. Combine the two Horn forms for carnivores into the form of disjunction of conjunctions.
4. (2 marks) List the three different types of attribute values with examples.
5. (2 marks) Explain how clustering and classification are different.
6. (4 marks) Show how to compute the information gain for *BigStar* in the case of *Country* = *USA*.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Film** | ***Country*** | ***Big Star*** | ***Genre*** | **Success** |
| Film 1 | *USA* | *Yes* | *SF* | True |
| Film 2 | *USA* | *No* | *Comedy* | False |
| Film 3 | *USA* | *Yes* | *Comedy* | True |
| Film 4 | *Europe* | *No* | *Comedy* | True |
| Film 5 | *Europe* | *Yes* | *SF* | False |
| Film 6 | *Europe* | *Yes* | *Romance* | False |
| Film 7 | *Other* | *Yes* | *Comedy* | False |
| Film 8 | *Other* | *No* | *SF* | False |
| Film 9 | *Europe* | *Yes* | *Comedy* | True |
| Film 10 | *USA* | *Yes* | *Comedy* | True |

* Gain = 1 – ∑ (the weighted entropy for each value in the attribute)
* *H*(*S*) = – *p*0 log2 *p*0 – *p*1 log2 *p*1 – ... (if there are other classes)

1. (4 marks) Complete the function that updates weights between hidden layer and output layer in a BNN.

/\* constants and arrays

ALPHA, NO\_NODES\_IN\_HIDDEN\_LAYER, NO\_NODES\_IN\_OUTPUT\_LAYER

Weight\_IH[][], Weight\_HO[][]

Output\_I[], Output\_H[], Output\_O[]

Expected[], Error[], Delta\_O[], Delta\_H

\*/

function update\_weights\_hidden\_output\_layers() {

for (var j = 0; j < NO\_NODES\_IN\_HIDDEN\_LAYER; j++) {

}

}

1. (4 marks) Consider the inverted pendulum problem. The fuzzification result for *Theta* is PS:0.25 and ZE:0.75, and the fuzzification result for *dTheta* is ZE:0.2 and PS:0.7. (Note that the numbers after fuzzy sets are membership values.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Theta* | | | | |
| *dTheta* |  | NM | NS | ZE | PS |
| NM |  |  | PM |  |
| NS |  |  | PS | ZE |
| ZE | PM | PS | ZE | NS |
| PS |  | ZE | NS |  |
| PM |  |  | NM |  |

1. Find the output fuzzy sets with membership values, using the above fuzzy rules.
2. Explain how to do defuzzification with the above output fuzzy sets.
3. (2 marks) Find *P*(**¬***catch*) from the next ***conditional probability tables***.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *toothache* | *cavity* | *toothache* | ¬*cavity* |  | *catch* | *cavity* | *catch* | ¬*cavity* |  | *cavity* |
| 0.6 | 0.1 |  | 0.9 | 0.2 |  | 0.2 |

1. (2 marks) Let *W* be “Car won’t start” and *B* be “Bad battery”. We know that when a battery is bad, the car won’t start. What is the probability of having a bad battery when a car won’t start, assuming the following probabilities? You should show not only how to compute the probability but also the probability (i.e., value) itself.

*P*(*W*) = 0.04

*P*(*B*) = 0.03

*P*(*W*|*B*) = 0.8