**Module 2**

**Decision Tree Learning**

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| 1 | Explain Decision Tree Learning and also explain the problem characteristics for which decision tree learning is suitable. | 4 Marks |
| 2 | Explain the concepts of entropy and information gain. | 6 Marks |
| 3 | Explain ID3 algorithm for decision tree learning with an illustrative example. | 6Marks |
| 4 | Explain which attribute is chosen as the best classifier in ID3 algorithm. | 6 Marks |
| 5 | Explain the construction of decision tree for the below given dataset using ID3 algorithm:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **outlook** | **temperature** | **humidity** | **wind** | **answer** | | Sunny | hot | high | weak | no | | sunny | hot | high | strong | no | | overcast | hot | high | weak | yes | | Rain | mild | high | weak | yes | | Rain | cool | normal | weak | yes | | Rain | cool | normal | strong | no | | overcast | cool | normal | strong | yes | | Sunny | mild | high | weak | no | | Sunny | cool | normal | weak | yes | | Rain | mild | normal | weak | yes | | Sunny | mild | normal | strong | yes | | overcast | mild | high | strong | yes | | overcast | hot | normal | weak | yes | | Rain | mild | high | strong | no | | 8 Marks |
| 6 | Consider the following dataset:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. | Student | First last year? | Male? | Works hard? | Drinks? | First this year? | | 1 | Richard | yes | yes | No | yes | yes | | 2 | Alan | yes | yes | Yes | no | yes | | 3 | Alison | no | no | Yes | no | yes | | 4 | Jeff | no | yes | No | yes | no | | 5 | Gail | yes | no | Yes | yes | yes | | 6 | Simon | no | yes | Yes | yes | no |  1. What is the entropy of this collection of training examples with respect to the target function classification? 2. Construct a minimal decision tree for this dataset. Show your work. | 8 Marks |
| 7 | 1. Use your decision tree from the previous part to classify the following instances:  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. | Student | First last year? | Male? | Works hard? | Drinks? | First this year? | | 7 | Matthew | no | yes | No | yes | ?? | | 8 | Mary | no | no | Yes | yes | ?? | | 8 Marks |
| 8 | Give decision trees to represent the following Boolean function:   1. A ʌ ~B 2. A V (B ʌ C) 3. A XOR B 4. (A ʌ B) V (C ʌ D) | 8 Marks |