# survival8



## BITS WILP Machine Learning End-Sem Exam 2016-H2



BITS WILP Machine Learning End-Sem Exam 2016-H2
(ML - IS ZC464 EC3R SEM1 2016-17)

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**Birla Institute of Technology & Science, Pilani**
**Work-Integrated Learning Programmes Division**
**First Semester 2016-2017**
**Comprehensive Examination (EC-3 Regular)**

| | |
|---|---|
| Course No. | : IS ZC464 |
| Course Title | : MACHINE LEARNING |
| Nature of Exam | : Open Book |
| Weightage | : 50% |
| Duration | : 3 Hours |
| Date of Exam | : 06/11/2016 (FN) |

No. of Pages = 2
*No. of Questions = 4*

Note:
1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

Q.1. Consider the two perceptron model of the given neural network (fig 1) to classify the test samples while the training samples are given in the adjoining table. [2 + 4 + 2 + 3 + 2 = 13]

| Feature f1 | Feature f2 | class |
|---|---|---|
| 1 | 1 | car |
| 1 | 4 | bus |
| 2 | 5 | bus |
| 1 | 2 | car |
| 4 | 2 | bicycle |
| 4 | 5 | scooter |
| 5 | 4 | scooter |
| 5 | 2 | bicycle |

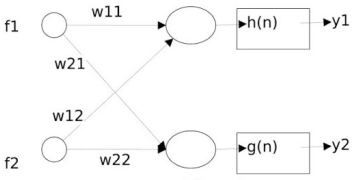

Figure 1

(a) Model the output in terms of y1 and y2.
(b) Obtain the weights appropriately to classify the test patterns correctly.
(c) Design the activation functions with threshold appropriately.
(d) Classify the input <2.1,4.5>. Show the relevant steps.
(e) Justify the need for two hidden neurons for processing the input.

Q.2. Consider the input output pairs <x,y> of the training data given as <1,1>, <1,2>, <2,2>, <3,3>, <5, 3>, <7, 8>, <6,4>, <7,5>, <6,7> and <4,4> . Let h(x) = w*x be the hypothesis in one parameter w (lines passing through the origin) used for line fitting for the given data, where w is to be taken as the slope of the line represented by the hypothesis. [4 + 3 + 3 = 10]



Page 2:

(a) Compute the squared error E(w) for varying values of w ={-1.0, -0.25, -0.5, 0, 0.25, 0.5, 1.0} and plot the error curve. Also mark the point of global minima on the plotted error curve.
(b) Define the best hypothesis and predict the value of x=6.2. Show the computation steps clearly.
(c) How do you view the problem of finding the best hypothesis in the given context as optimization problem. How can you apply genetic algorithm in obtaining best hypothesis? Explain.

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Q.3. Consider the following data. The answer key is Own House which has only two values 'No' and 'Yes'. The attributes used for training are 'Education', 'Annual Income', 'Age', 'Gender' and 'Credit Ranking'. The decision tree is constructed using the training data given below. [4 + 4 + 4 + 3 = 15]

| Education | Annual Income | Age | Gender | Credit ranking | Own House |
|---|---|---|---|---|---|
| College | High | Old | Male | Good | Yes |
| High school | Middle | Middle | Male | Good | Yes |
| High school | Middle | Young | Female | Good | No |
| College | High | Old | Male | Poor | Yes |
| College | High | Old | Male | Good | Yes |
| College | Middle | Young | Female | Good | No |
| High school | High | Old | Male | Poor | Yes |
| College | Middle | Middle | Female | Good | No |
| High school | Middle | Young | Male | Poor | No |

(a) Compute the total information content of the training data with respect to the answer key.[Hint: Use Entropy to represent the total information content]
(b) Compute the GAIN(Annual Income) using the method discussed in the class. Show all the steps of computation.
(c) Compute the best attribute among the attributes Education, Annual Income and Age. Show all the steps neatly.
(d) Draw the complete decision tree. What is the height of your decision tree?

Q.4. Answer the following questions [4 + 4 + 4 = 12]
(a) A Ph.D. graduate has applied for a job with two universities: A and B. The graduate feels that she has a 60% chance of receiving an offer from university *A* and a 50% chance of receiving an offer from university *B*. If she receives an offer from university *B*, she believes that she has an 80% chance of receiving an offer from university A. What is the probability that both universities will make her an offer? If she receives an offer from university B, what is the probability that she will not receive an offer from university A?
(b) Explain the applicability of support vector machines (SVM) in classification. How is SVM different from the artificial neural networks?

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Page 3:
Q.4.C. Explain Gradient descent method for weight learning using appropriate figures and equations. What are the limitations of gradient descent method?

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