

ICS 171 — Quiz #5 — TWENTY (20) minutes

1. (5 pts) NAME AND EMAIL ADDRESS: _____

YOUR ID: _____ ID TO RIGHT: _____ ROW: _____ NO. FROM RIGHT: _____

2. (10 pt each, 40 pts total) Probability, Bayes' rule.

NOTE: You don't need a calculator for this problem, the numbers have been chosen so that the arithmetic is simple. SHOW YOUR WORK.

We have a database describing 100 examples of printer failures. Of these, 75 examples are hardware failures, and 25 examples are driver failures. Of the hardware failures, 15 had Windows operating system. Of the driver failures, 15 had Windows operating system.

2.A. Write down the definition of $P(\text{Windows}|\text{hardware})$ as a function of $P(\text{hardware})$ and $P(\text{Windows AND hardware})$.

$$P(\text{Windows}|\text{hardware}) = \frac{P(\text{Windows AND hardware})}{P(\text{hardware})}$$

2.B. Calculate $P(\text{Windows}|\text{hardware})$ using the definition and the information in the problem.

$$P(\text{Windows}|\text{hardware}) = \frac{(15/100)}{(75/100)} = 1/5$$

2.C. Write down Bayes' rule for $P(\text{driver}|\text{Windows})$ as a function of $P(\text{driver})$, $P(\text{Windows})$, and $P(\text{Windows}|\text{driver})$.

$$P(\text{driver}|\text{Windows}) = P(\text{Windows}|\text{driver}) \left(\frac{P(\text{driver})}{P(\text{Windows})} \right)$$

2.D. Calculate $P(\text{driver}|\text{Windows})$ using Bayes' rule and the information in the problem.

$$P(\text{driver}|\text{Windows}) = (15/25) \left(\frac{25/100}{30/100} \right) = 1/2$$

3. (5 pt each, 30 pts total) Perceptron learning.

Label the following statements as Y (= yes) or N (= no).

3.A. N Suppose that you are given two weight vectors for a perceptron. Both vectors, \mathbf{w}_1 and \mathbf{w}_2 , correctly recognize a particular class of examples. Does the vector $\mathbf{w}_3 = \mathbf{w}_1 - \mathbf{w}_2$ ALWAYS correctly recognize that same class?

3.B. Y Does the vector $\mathbf{w}_4 = \mathbf{w}_1 + \mathbf{w}_2$ ALWAYS correctly recognize that same class?

3.C. Y Does the vector $\mathbf{w}_5 = c\mathbf{w}_1$ where $c = 42$ ALWAYS correctly recognize the same class?

3.D. N Does the vector $\mathbf{w}_6 = d\mathbf{w}_2$ where $d = -117$ ALWAYS correctly recognize the same class?

3.E. N Now suppose that you are given two examples of the same class A, \mathbf{x}_1 and \mathbf{x}_2 , where $\mathbf{x}_1 \neq \mathbf{x}_2$. Suppose the example $\mathbf{x}_3 = 0.5\mathbf{x}_1 + 0.5\mathbf{x}_2$ is of a different class B. Is there ANY perceptron that can correctly classify \mathbf{x}_1 and \mathbf{x}_2 into class A and \mathbf{x}_3 into class B?

3.F. Y Suppose that you are given a set of examples, some from one class A and some from another class B. You are told that there exists a perceptron that can correctly classify the examples into the correct classes. Is the perceptron learning algorithm ALWAYS guaranteed to find a perceptron that will correctly classify these examples?

4. (2.5 pt each, 15 pts total) Reasoning, logic.

Answer Y = YES or N = NO.

4.A. Y In Abductive reasoning (Abduction) you make an assumption which, if true, together with your general knowledge, will explain the facts.

4.B. N Abductive reasoning is sound.

4.C. Y In Inductive reasoning (Induction) you generalize from many instances to a rule for all instances.

4.D. N Inductive reasoning is sound.

4.E. Y In Deductive reasoning (Deduction) you reason from facts and general principles to other facts.

4.F. Y Deductive reasoning is sound.