HOCHSCHULE BONN-RHEIN-SIEG

PMR, Quiz 02

SUMMER SEMESTER 2018

1. Answer the following questions:

   (a) Write down the three axioms of probability theory.

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   (b) What is the qualification problem?

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   (c) What are the reasons for the failure of logic to describe large domains, such as robotics?

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   (d) Describe the principle of maximum expected utility.

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   (e) What is a random variable?

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   (f) Draw a Venn diagram that illustrates the definition of conditional probability.

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   (g) What do conditional probabilities represent?

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2. Let's suppose that there is a box of tools in our RoboCup@Work lab and that one of our robots has to take one of the tools out of the box. The box has 100 tools inside - 20 wrenches, 50 screwdrivers, and 30 pairs of pliers. If the robot picks a wrench, there is a 0.2 probability that it will drop it; similarly, there is a 0.1 probability that it will drop a screwdriver and a 0.3 probability that it will drop a pair of pliers.

(a) What prior probabilities do we know in this case?

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(b) What is the probability of not picking a wrench?

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(c) What is the probability that the robot will pick up a screwdriver and drop it?

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3. We are now going to explore the previous problem in a more formal way. Let's assume that we have a discrete random variable X that describes the outcome of the box picking action; X can thus take three values, let's say 1, 2, and 3, which correspond to the outcomes wrench, screwdriver, and pair of pliers respectively. We also have a binary random variable Y, which takes the values 0 and 1, corresponding to whether a tool was dropped or not.

   (a) Write down $f(x)$, the probability distribution function of X.

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   (b) Write down the conditional probability distribution $f(y|X = 1)$.

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   (c) What is the expected value of Y given $X = 2$, namely $E[Y|X = 2]$?

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Name: _____ Enrolment number: _____ Points: __ / 20