

COMP2711H Tutorial 5

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1 Bayes' Theorem

Exercise 1.1. Suppose we have found that the word 'Rolex' occurs in 250 of 2,000 messages known to be spam and in 5 of 1,000 messages known not to be spam. Estimate the probability that an incoming message containing the word 'Rolex' is spam, assuming that it is equally likely that an incoming message is spam or not spam. If our threshold for rejecting a message as spam is 0.9, will we reject this message?

Exercise 1.2. Suppose one person in 100,000 has a particular rare disease for which there is a fairly accurate diagnostic test. This test is correct 99% of the time when given to someone with the disease; it is correct 99.5% of the time when given to someone who does not have the disease. Given this information, can we find

- (a) the probability that someone who tests positive for the disease has the disease?
- (b) the probability that someone who tests negative for the disease does not have the disease?

2 Conditional Probability

Exercise 2.1. The player throw a die. The player wins if the first throw is 6, loses if it is 1. Any other throw if called his "point". If the first throw is a point, the player throws the die repeatedly until he wins by throwing his point again or loses by throwing 6. What is the player's chance to win?

3 Deferred Decision

Exercise 3.1. We roll two standard six-sided dice. What is the probability that the sum of the dice is even?

Exercise 3.2. We roll ten standard six-sided dice. What is the probability that the sum of the dice is divisible by six?

References

- [1] M. Mitzenmacher and E. Upfal. *Probability and computing: Randomized algorithms and probabilistic analysis*. Cambridge University Press, 2005.
- [2] F. Mosteller. *Fifty challenging problems in probability with solutions*. Courier Dover Publications, 1987.
- [3] D.-Y. Yeung. *COMP2711h Lecture Notes*.