Engsci 213 Probability Problems (v. 1)

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Basic probability problems

Problem

Let's consider some simple probability problems.

300 software engineers were randomly selected and asked about their operating system preferences in 2008. Of the respondents, 33% played computer games. The respondents were asked which operating system they would like if they could choose any operating system at all. 13% of respondents played computer games and chose OSX. 12% did not play computer games and chose OSX.

What is the probability that a randomly chosen respondent

- would choose OSX?

- either plays computer games or would choose OSX (or both)?

Respondents were also asked their opinions about operating system reliability and memory usage. 84% of respondents considered reliability to be of high importance, while 40% considered memory usage to be of high importance.

What is the probability of a respondent

- Not considering reliability important?

- Considering both reliability and memory usage to be important? (April fools!)

- Given the extra information that 12% of respondents consider neither reliability nor memory usage important, find the answer to the previous question.

Conditional probability problems (including Bayes, independence etc)

Problem

Toss a die once.

Let event A = "get a 6"

Let event $B =$ "get an even number"

If the die is fair then $P(A) = 1/6$ and $P(B) = 1/2$.

What are $P(A|B)$ and $P(B|A)$?

Problem

Joe catches the ferry to town every day. The ferry is on time with probability 0.6 and late with probability 0.4.

When the ferry is on time it is crowded with probability 0.5. When it is late, it is crowded with probability 0.7. The ferry is noisy with probability 0.8 when it is crowded and with probability 0.4 when it is not crowded.

- Write conditional probability statements representing the information given.
- What is the probability that the ferry is crowded?
- What is the probability that the ferry is noisy?

Unreliable computer

You own an unreliable computer. It will crash with probability 0.5 if you regularly update its software and with probability 3/4 if you don't. Software updating is done overnight and automatic but is unreliable and fails with probability 2/3.

Your computer crashes. You didn't check whether it had updated or not. What is the probability that the software was updated?

Defective chips

Intel microchips are produced in 3 different factories, accounting 50%, 30% and 20% of the total output respectively.

The percentage of defective microchips from 3 factories is, respectively, 0.4%, 0.6% and 1.2%.

A software engineer who only buys Intel chips finds a defective chip. What is the probability that it came from factory 1?

Selecting computer games

A box contains contains s strategy games and f first-person action games. Draw 3 games without replacement. What is the probability of getting the sequence (strategy, action, strategy)?

Monty Hall problem

Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?

Using random variables

Toss a fair coin three times. What is the sample space?

Define the random variable which counts the number of heads in a given outcome. What is the probability of the event associated to each possible value of the random variable.

Counting and probability

We didn't spend much time on this but see pages 10-11, worked examples 1.24 and 1.25 in 'probability-past-course-notes.pdf' on Canvas. These should be relatively straight-forward.