CS 145 – Foundations of Computer Science

Professor Eric Aaron

Lecture – T R 3:10pm
Lab – M 3:10pm

Lecture Meeting Location: OH 162
Lab Meeting Location: SP 309

Business

• HW7 due soon!
  – (As always, see HW sheet for deadlines)

• Reading: Ch. 6
  – We may not cover all the material in chapter 6, but it’s worth reading anyway

• Scheduling the Final Exam review session
Expected Values

- When the elements in a sample space have probabilities associated with them (e.g., the chance that a lottery ticket is a winner)
- ... and those outcomes have values (or payoffs) associated with them,
- ... we can talk about the expected value (or expectation) of an outcome—-the probability-weighted average value of the payoff function
- More formally
  - Let S be a sample space, p be a probability distribution on S
  - ... and let f be a payoff function that maps each element of S to a real number (it could be any real number, positive or negative)
  - Then the expected value of f given p is $\sum f(s)\cdot p(s)$, summed over all s in S
  - Example: What is the expected value of a roll of a fair 6-sided die?

Expected Values

- We can talk about the expected value (or expectation) of an outcome—the probability-weighted average value of the payoff function
  - The expected value of f given p is $\sum f(s)\cdot p(s)$, summed over all s in S
- Example: A fair coin is flipped three times.
  - Let S be the sample space of the eight possible outcomes, and
  - ... let f be the payoff function that maps each element of S to the number of heads in that outcome
- What is the expected value of f?
Digression: What’s A Number?

- Actually, the question is “How do we represent numbers?”
- Several possibilities – We’re used to decimal (i.e., base 10), using digits 0 through 9, but there are also:
  - Binary (base 2): using digits 0 and 1
  - Octal (base 8): using digits 0 through 7
  - Hexadecimal (base 16): using “digits” 0 through “15” (?)
    - (we use letters A-F to represent numbers 10-15)
    - (Why are these three possibilities well-suited for computers?)
- In all cases, each digit represents a number of (base^{position})
  - e.g., in base 10: \(209 = 2 \times 10^2 + 0 \times 10^1 + 9 \times 10^0\)
  - (in base 100: \(29_{100} = 2 \times 100^1 + 9 \times 100^0 = 209\))
  - in base 2: \(1010_2 = 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 = ??\)
  - in base 16: \(A3E_{16} = 10 \times 16^2 + 3 \times 16^1 + 14 \times 16^0 = ??\)
Digression: Converting Between Number Bases

- We indicate the base of a number by a subscript
  - e.g., $1101_2$ is in binary, $1101_{16}$ is in hexadecimal
  - We omit the subscript for decimal numbers
- How to convert between bases?
  - $47 = ??_2$; $51 = ??_{16}$; $51_8 = ??$
  - $29_{100} = ??$
  - $10100010_2 = ??_{16}$; $1F_{16} = ??_2$
  - What’s the trick with these last two?
  - (Can double-check conversions by going through base 10)