

Stat 230: Probability

Monte Carlo Day

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Wednesday, July 6th

Example

Joe is asked by his boss to compute some probabilities. However, rather than compute the probabilities by hand, can he harness randomness?

Review

For today:

(1) Monte Carlo Day!!

Upcoming:

(1) Monday: Quiz 5

Background

- Mid-1940s
- John von Neumann and Stanislaw Ulam (Nicholas Metropolis)
- Idea of using random numbers to solve problems encountered in the development of the atomic bomb
- Monte Carlo refers to the famous casino in Monaco, where randomness is also used in a repetitive way
- General Class

Background

- Re-run an experiment many times under random conditions and results tend to long-run average
- Process
 - (1) Setup Model
 - (2) Generate parameters and random variables
 - (3) Perform deterministic computation
 - (4) Aggregate results

Background

- Law of large numbers
- Central limit theorem

Examples

Example (Area)

Consider the quarter unit circle.

- (1) How could we determine the area?
- (2) What if this had twice the radius?

Examples

Example (Select Hearts)

Consider selecting 5 cards from a deck of cards (without replacement).

(1) What is the expected number of hearts drawn?

Examples

Example (Maximum of 3 Dice)

Consider X to be the maximum value of 3 dice

- (1) What is the probability function?
- (2) What is the expected value?

Examples

Example (FLUFFY)

Consider from test 1, reorganizing the word fluffy.

- (1) What is probability of fluffy?
- (2) What is the probability of fluffy given ff occurs?

Examples

Example (Normal CDF)

Consider X to be a standard normal random variable

(1) What is $F(0)$? $F(1)$? $F(2)$?

Examples

Example (Risk)

When playing Risk,

- (1) What are the odds of winning when X attacking troops face Y defending troops?
- (2) In a single roll, what is the win-lose probabilities?

