

Games of Chance

# The Theory of Games

# Today's question



Given a fixed budget, how should we play the machines?

# Some basic probability

- What does 'probability' mean?
  - Relative frequency of occurrence of an event

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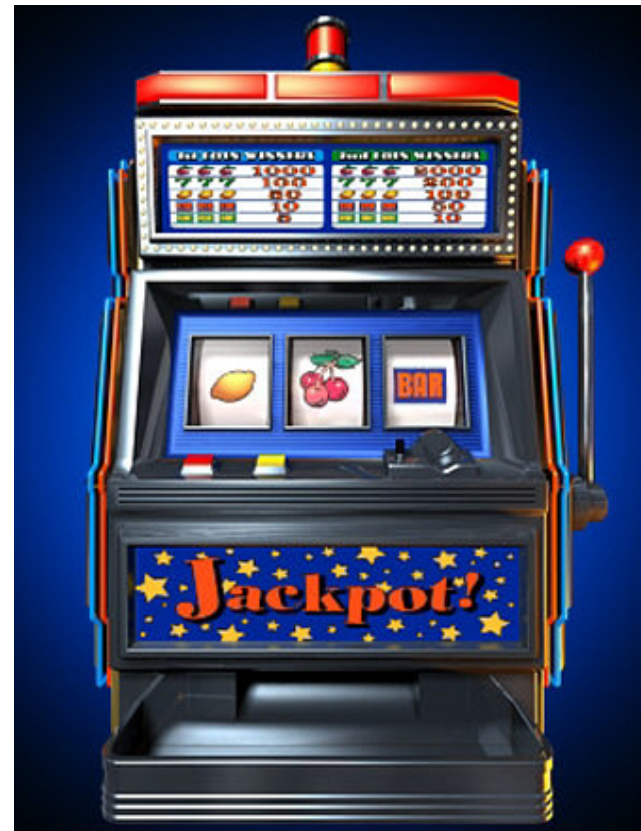
Long term

# More probability

MACHINE 1



MACHINE 2



# More probability

## MACHINE 1

Costs \$5 to play

Pays you \$105 with  
probability  $1/5$

## MACHINE 2

Costs \$1 to play

Pays you \$1001 with  
probability  $1/50$

Which one is the better machine to play?

# More probability

**MACHINE 1**

Average payoff = \$16

**MACHINE 2**

Average payoff = ~\$18

So always play machine 2!

# More probability

- Probability
  - 'How likely am I to hit the jackpot?'
- Expected value
  - 'How much on average will I make playing this machine?'



# Multi-armed bandits



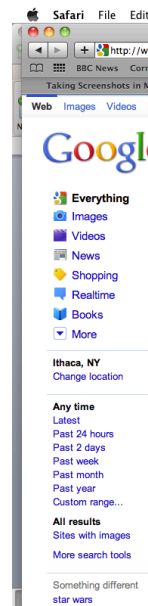


# Multi-armed bandits

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- Two competing forces
  - 'Exploration' – try out a new machine
  - 'Exploitation' – stick with the reliable machine
- Examples?

# Multi-armed bandits



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# Recap

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