APPROXIMATION ALGORITHMS

MULTIPLICATIVE WEIGHTS ALGORITHM

RASMUS PAGH
UNIVERSITY OF COPENHAGEN

SPECIAL GUEST STAR:
TIM ROUGHGARDEN, COLUMBIA UNIVERSITY

TODAY

- WE PLAY AN UNFAIR GAME, MAKE IT LESS UNFAIR

- BRIEF INTRO TO ON-LINE ALGORITHMS

- "GUEST LECTURE" BY TIM ROUGHGARDEN
    - ON-LINE DECISION MAKING
    - LOWER BOUNDS ON APPROXIMATION
    - UPPER BOUND VIA "MULTIPLICATIVE WEIGHTS"

A~~NNNNNN~~ ~~UN~~FAIR GAME

MORE

- A VOLUNTEER PLAYS AN ADVERSARY (RASMUS)

- EACH ROUND: THE VOLUNTEER PLAYS *A DISTRIBUTION OVER* "HEADS" OR "TAILS".

  $a^i = 0$ $a^i = 1$

- THEN THE ADVERSARY CHOOSES A REWARD VECTOR $r^i \in [-1, +1]^2$, THAT SPECIFIES THE REWARD FOR $a^i \in \{0,1\}$.

- THE VOLUNTEER RECEIVES *EXPECTED* REWARD $[r^i_{a^i}]$, a^i CHOSEN FROM DISTRIBUTION

"DECISIONS ON THE FLY"

ON-LINE ALGORITHMS

- INPUT IS REVEALED "ONE PIECE AT A TIME"

- A DECISION NEEDS TO BE MADE IMMEDIATELY
  (CANNOT BE CHANGED)

- EXAMPLES OF ON-LINE ALGORITHMS:
  - GREEDY SCHEDULING OF JOBS ON MULTIPLE MACHINES
  - FIRST FIT ALGORITHM FOR BIN PACKING
    (NOT FIRST FIT DECREASING)

- GOAL: GET PERFORMANCE THAT "APPROXIMATES"
  THE OPTIMAL "OFF-LINE" ALGORITHM.
  ↑
  ALL DATA
  AVAILABLE FROM
  START

NEXT VIA YOUTUBE:
MULTIPLICATIVE
WEIGHTS