Greedy Alg:
While change to make remains
throw in the largest coin that is not
larger than the change to make

PENNY, NICKEL, DIME, QUARTER

PROVE: GREEDY ALG YIELDS CHANGE W/FEWEST COINS.

PROOF:

$0.00 - $0.04 ⇒ 0 to 4 PENNIES
CLEARLY NO ALT. SOL'N.
IS GREEDY ✓

$0.05 - $0.09 ⇒ OUR ALG: NICKEL + PENNIES
CLEARLY NO DIME ~~OR NICKEL~~, OR QTR
CAN OPT SOL'N INCLUDE NO NICKELS?
THEN WOULD HAVE ≥ 5 PENNIES
SUB ONE NICKEL FOR 5 PENNIES
AND IMPROVE SOL'N. ✗
SO OUR ALG WORKS ✓

$0.10 - $0.24 SKIPPING DETAILS ✓
(a) Show at least one dime by e.g. like
(b) divide into dime + $0.00 - 0.14
$0.00 - $0.09 already taken care of
$0.10 - $0.14 already taken care of

$0.25 and above.
If optimal includes at least one QTR, then
remove QTR from opt + greedy and continue proof.
Then, assume (only new case) OPT has no QTRs
and ≥ $0.25.
If coins in OPT total to $0.25, then repl QTR : contradiction.
So, no coins totalling to $0.25.

TAKE OUT DIMES, NICKELS, + PENNIES AS NEEDED TO GET TO \$0.25 – 0.34

25-29: CONSIDER n = 25-29

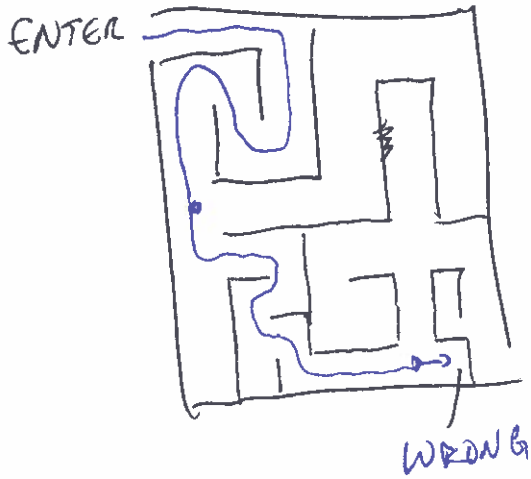
OPT MUST USE ≥ n – 25 PENNIES PLUS ONE MORE COIN

GREEDY CAN MAKE THE SAME CHANGE W/ NO MORE COINS AS QTR + n-25 PENNIES

30-34: OPT MUST USE ≥ n-30 PENNIES + THREE MORE COINS

GREEDY USES FEWER: QTR + n-30 PENNIES

CONTRADICTION

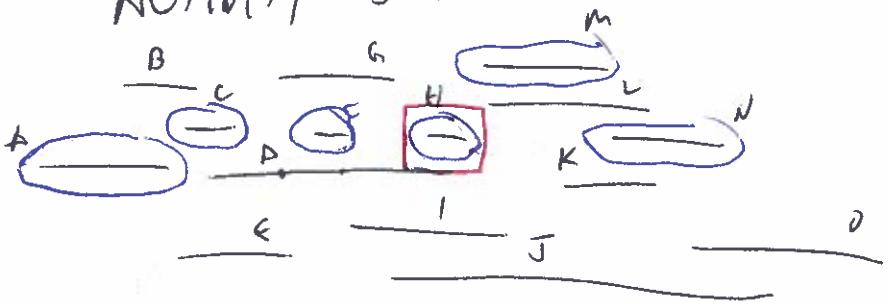


NOT GREEDY

- COIN CHANGING, OUT OF NICKELS
- MAZE SOLVING
- GETTING TO CAMPUS DURING OLYMPICS + PARALYMPICS / GPS NAV SYS IN GENERAL

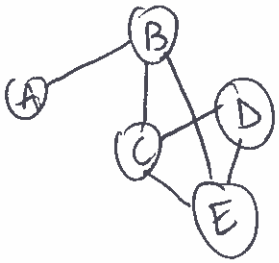
IOU: opt w/out optimal substructure
and maybe brownies and/or a song

ACTIVITY SELECTION



SCHED AS MANY NON-OVERLAPPING EVENTS AS POSSIBLE

SIDENOTE: THIS IS A GRAPH PROBLEM



EDGE COVER??

COULD MAGICALLY PICK H

DIVIDE INTO ACTS THAT END BEFORE H STARTS } OPT SOL'N
ACTS THAT START AFTER H ENDS } OPT SOL'N

PUT THESE TOGETHER AND DONE!

OPTIMAL SUBSTRUCTURE

X [SCAN FOR MAGIC
$T(n) = n \cdot 2T(\frac{n}{2}) + n$

X [BRUTE FORCE: $2^n - 1$ possibilities

TRY GREEDY

- SHORTEST/LONGEST X
- EARLIEST START X
- EARLIEST FINISH ?
- LEAST CONFLICT ?

$O(n \lg n)$ [SORT A by finish time

$O(n)$ [WHILE A is not empty

Add A[0] to soln (call it X)

While A is not empty

POP THE 1st ELT OF A IF IT STARTS BEFORE X FINISHES] $O(1)$ ← MAX n time

] $O(n \lg n)$

] $O(1)$? At most $O(n)$ times

Assume $\exists$ OPT(S) where $|OPT(S)| < |GREEDY(S)|$

Consider the earliest finish time activity at which they differ a_i.

$a_i \in GREEDY(S)$ but $a_i \notin OPT(S)$

OPT must take ≥ 1 other activity not in GREEDY(S) AFTER BREAK

$= 1$ not a problem

> 1 WHY? CONTRA

a_i

$a_i \notin GREEDY(S)$ but $a_i \in OPT(S)$

Go to look the same up to a_i

Does a_i conflict w/earlier activities in GREEDY(S)? NO

a_i does not conflict w/earlier activities in OPT(S).

Then GREEDY ALG would take a_i.

CONTRADICTION