

COP 3502 9/10/25

BRUTE FORCE

10 tasks any order what's the best order?

10! orderings $\rightarrow$ enumerate $\rightarrow$ evaluate
 $\rightarrow$ PICK BEST!

func (PARTIAL SOLUTION, int k)

tasks
filled in
next OPEN
INDEX TO FILL IN

ODOMETER

0 0 0 0

0 0 0 1

0 0 0 2

0 0 1 0

⋮

2 2 2 2

ODOMETER(0 1 1 1, k=2, d=3)

Print out all odometer settings
starting 0 1 1 1, using 3 digits
of length 4.

0 1 0 0
0 1 0 1
0 1 0 2

ODOMETER(0 1 1 0, k=3
d=3, n=4)

for (int i=0; i<d; i++)
arr[k]=i
ODOMETER(arr, k+1, d, n)

0 1 1 0

0 1 1 1

0 1 1 2

0 1 2 0

0 1 2 1

0 1 2 2

ODOMETER(0 1 1 1, k=3
d=3, n=4)

ODOMETER(0 1 2 1, k=3, d=3
n=4)



COMBINATIONS (# of combos n items = 2^n)

$\{0, 1, 2, 3, 4\}$

$\{\}$

$\{0\}$

$\{0, 1\}$

$\{1\}$

$\{2\}$

$\{0, 2\}$

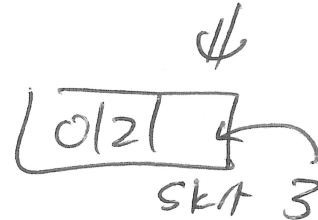
$\{1, 2\}$

$\{0, 1, 2\}$

ADD 3

$\{3\}$

$\{0, 3\}$



Today



Bitwise

Ops



0, 1, 2

1, 4

0	1	2	3	4
1	1	1	0	0
0	1	0	0	1

4	3	2	1	0
0	0	1	1	1
1	0	0	1	0

1 to 1 correspondence btw
binary order settings
AND SUBSETS

PERMUTATIONS

0, 1, 2

0, 2, 1

1, 0, 2

1, 2, 0

2, 0, 1

2, 1, 0

ODOMETER BUT

DIGIT REPEATS NOT ALLOWED

→

→

arr

↓

used

T T F T F F T

PERM ([3 | 0 | 6 | 1 | | |], k=4, n=7)

if (used[i])
continue;

BENEFIT OF
USING EXTRA
MEMORY ⇒
SAVED TIME

NOW ADD COMPLEXITY
OF MAINTAINING
THOSE VARIABLES

for (int i=0; i<n; i++) {
if (i was tried) continue;

→ arr[k] = i;
↓
used[i] = ~~true~~ 1;
gets here i = 2, 4, 5

[perm(arr, k+1, n);

used[i] = 0;

↑ allows me to place
new item in slot k.

3 0 6 1 2 4 5
3 0 6 1 2 5 4
3 0 6 1 4 2 5
3 0 6 1 4 5 2
3 0 6 1 5 2 4
3 0 6 1 5 4 2