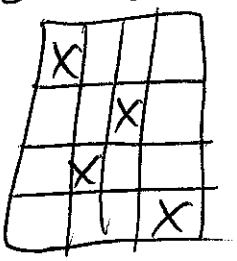
T: Backtracking

R: Foundation Exam, Final Exam

→ it's "smart" brute force

8 QUEENS



0,2,1,3

1 sol

↳ permutation

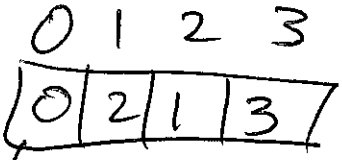
0,1,2,3

0,1,3,2

0,2,1,3

⋮

3,2,1,0



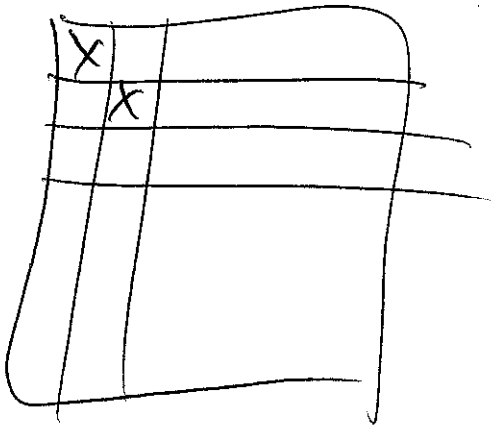

```
for (i=0; i<n; i++)
    for (j=i+1; j<n; j++)
        if (abs(i - j) ==
            abs(perm[i] - perm[j])
            perm[i]
return 0;
```

runtime

$8! \times 8^2/2$

$O(n!\,n^2)$

Can we do better?



(0,1, ... ,7)
(0,1, ...)
(0,1,7,6,5,4,3,2)

] 6! perm

Backtracking says don't list ALL possibilities completely. Rather start building partial solutions and skip building off of them if they're doomed to fail!

Rec Perm

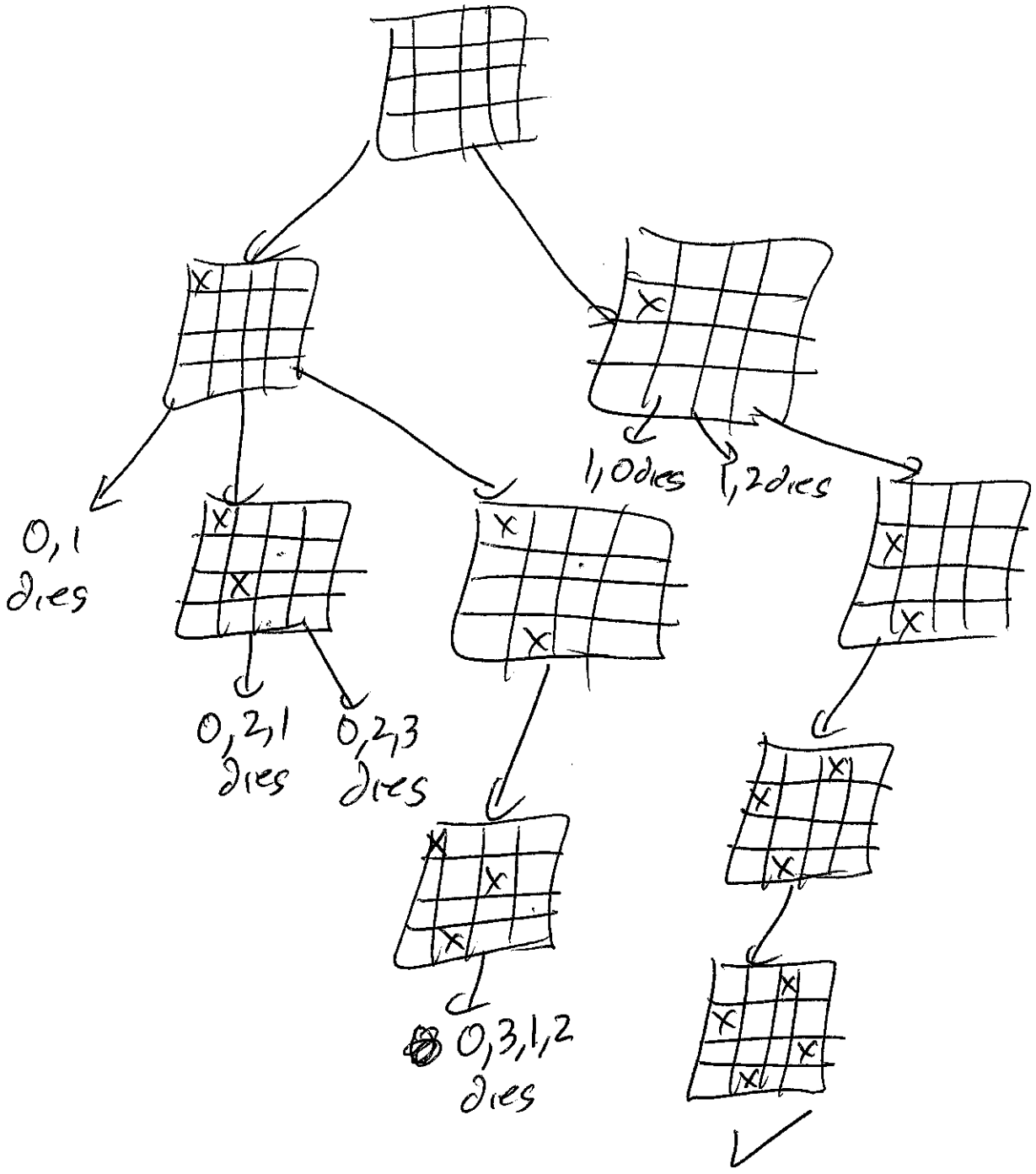
```
if (k == n) {
    Process
}
else {

    for (i=0; i<n; i++) {
        if (!used[i]) {
            used[i]=1;
            sol[k]=i;
            //recursive call
            used[i]=0;
        }
    }
```

&& CONDITION

if (CONDITION)

If this doesn't hold SKIP trying i in slot k.

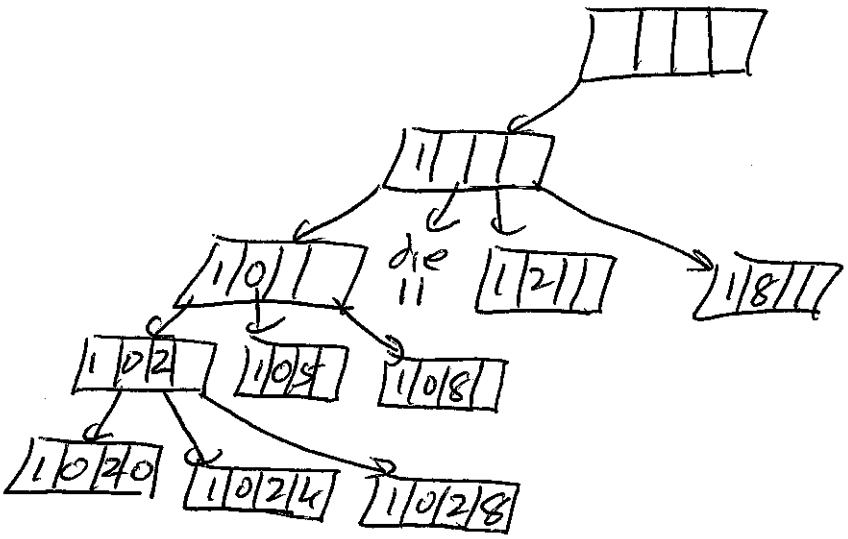

0,1
dies
0,2,1
dies
0,2,3
dies
1,0 dies
1,2 dies
0,3,1,2
dies

4/18/2017 (4)

Digit Divisible Integer is an integer such that its 1st k digits are divisible by k for all $1 \leq k \leq n$, where n is the # of digits in the number.

12325

1 is divisible by 1
12 is divisible by 2
123 is = = 3
1232 = = by 4
12325 = = by 5



(0) DIGIT DIVISIBLE CODE
(1) COP3502 - FINAL EXAM
(2) FOUNDATION EXAM

FINAL EXAM

All Free Response
2 PARTS:

4/27/2017
THURSDAY

4-6 Pm Part A (100 pts) - EVERYONE
2 HR TIME LIMIT

6-6:45 Pm Part B (25 pts) - DIDN'T DO COM SERVICE
45 MIN TIME LIMIT

EXAM AIDS: 4 sheets of notes (front/back)

EVERYTHING IS FAIR GAME

IMPORTANT TOPICS

Recurrence Relations
Bitwise Ops
Coding LL, Binary Trees

60%

FOCUS ON THESE TOPICS

FOUNDATION EXAM (FALL 2016 – PRESENT)

TESTS ONLY CS1.

OFFERED THE 1st SATURDAY OF EACH SEMESTER (EXCEPT IF THERE IS A FOOTBALL GAME, THEN SUNDAY).

REQUIRED TO PASS FOR ALL COMP SCI MAJORS.

YOU MAY TAKE THE EXAM UPTO 3 TIMES MAXIMUM, WITHIN ONE YEAR OF PASSING CS1.

IF YOU PASS THIS CLASS, YOUR 3 OPPORTUNITIES TO TAKE THE EXAM ARE: MAY 20, 2017 (SUMMER)
AUG 26, 2017 (FALL)
JAN 13, 2018 (SPRING)

GOALS: (1) GET MORE STUDENTS TO PASS (REMOVING COT 3100)
(2) GET STUDENTS TO GRADUATE FASTER (LIMITING TIME TO PASS)

NO NEED TO BE ENROLLED IN THE SEMESTER YOU TAKE THE EXAM.

NO NEED TO BE A CS MAJOR CURRENTLY TO TAKE THE EXAM.

```
int countBefore(btNode* root, char target[]) {
    if (root == NULL) return 0;
    if (strcmp(target, root->word) < 0)
        return countBefore(root->left, target);
    else
        return 1 + countBefore(root->left, target) +
               countBefore(root->right, target);
}
```

```
return 1 + root->left->count +
       countBefore(root->right, target);
```