

FIND ALL SUBSETS OF A GIVEN SET

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SUPPOSE WE HAVE THE SET

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

THE SUBSETS OF THIS SET ARE

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

THERE ARE 2^4 SUBSETS OF THIS SET, IF WE HAVE A SET OF N ELEMENTS THE NUMBER OF SUBSETS WILL BE 2^N


LET'S BREAK THIS DOWN ...

CONSIDER A SET OF 1 ELEMENT

$\{1\}$

SUBSETS ARE:

$\{1\}, \{\}$




CONSIDER A SET OF 2 ELEMENTS

$\{1, 2\}$

SUBSETS ARE:

$\{\}, \{1\},$
 $\{2\}, \{1, 2\}$




CONSIDER A SET OF 3 ELEMENTS

$\{1, 2, 3\}$

SUBSETS ARE:

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



CREATE THE SUBSETS OF VERY
SMALL SETS FIRST

THEN FOR EVERY SUBSET, ADD
A NEW ELEMENT IN TO
CREATE NEWER SUBSETS

REPEAT TILL ALL ELEMENTS
FROM THE ORIGINAL SET
HAVE BEEN USED

WHAT IS THE BASE CASE?

1. WHEN THE ORIGINAL SET IS EMPTY, ONLY THE EMPTY SET IS IT'S SUBSET

WHAT IS THE RECURSIVE CASE?

ADD THE ELEMENTS TO THE EXISTING SUBSETS TO CREATE NEW SUBSETS

SUBSETS

THIS HOLDS THE SUBSETS OF THE ORIGINAL SUPERSET

```
public static void populateSubsets(List<List<Integer>> subsetList, List<Integer> numberList) {  
    if (numberList.isEmpty()) {  
        subsetList.add(new ArrayList<>());  
        return;  
    }  
  
    int currentNum = numberList.get(0);  
    numberList.remove(0);  
  
    populateSubsets(subsetList, numberList);  
  
    List<List<Integer>> iteratingList = new ArrayList<>();  
    iteratingList.addAll(subsetList);  
    for (List<Integer> subset : iteratingList) {  
        List<Integer> newSubset = new ArrayList<>();  
  
        newSubset.addAll(subset);  
        newSubset.add(currentNum);  
  
        subsetList.add(newSubset);  
    }  
}
```

THIS IS THE ORIGINAL SET

RECURSION BASE CASE, THE EMPTY SUPERSET HAS JUST ONE SUBSET, THE EMPTY SET

REMOVE THE FIRST NUMBER FROM THE ORIGINAL SET AND FIND THE SUBSETS OF THE REMAINING NUMBERS

CREATE A NEW SUBSET FROM THE ORIGINAL SET ADDING THE CURRENT NUMBER BACK

POPULATE SUBSETS WITH ONE ELEMENT REMOVED

SINCE THERE ARE 2^N SUBSETS
THE COMPLEXITY OF THIS
CODE IS $O(2^N)$

THIS CANNOT BE REDUCED
FURTHER