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**Assignment**: Given a set S, generate all subsets of it, i.e. find power set of set S.

**Objective**:

If a set has n elements, it will have 2n  subsets. Therefore, its power set will contain these 2n  elements. We will randomly generate sets of different sizes using all the digits and all the upper and lower case letters from the alphabet. Then we will generate their power sets and record the time required the generate it. We will also plot the time against the set size and observe the growth of the power-set generating function.

**Machine Specifications:**

Processor: Intel® Core™ i7-8550U CPU @ 1.80 GHz 1.99GHz

Ram: 8 GB

System Type: 64-bit operation system

**Data Table:**

|  |  |
| --- | --- |
| **Set Size** | **Time required (microseconds)** |
| 5 | 0 |
| 6 | 0 |
| 7 | 0 |
| 8 | 0 |
| 9 | 0 |
| 10 | 0 |
| 11 | 996 |
| 12 | 1992 |
| 13 | 1984 |
| 14 | 3990 |
| 15 | 8975 |
| 16 | 12967 |
| 17 | 26927 |
| 18 | 47859 |
| 19 | 74797 |
| 20 | 173537 |
| 21 | 416909 |
| 22 | 723013 |
| 23 | 1856040 |
| 24 | 3658219 |
| 25 | 7350411 |
| 26 | 19940681 |
| 27 | 39681942 |
| 28 | 80812979 |
| 29 | 168026866 |
| 30 | 342465779 |

**Complexity Analysis:**

The function to generate power set has two nested loops. The outer loop runs in O (2n) and the inner loop runs in O (n). Therefore, the total complexity of the function is O (n.2n) and we can see that the function grows exponentially as input size is increased.

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