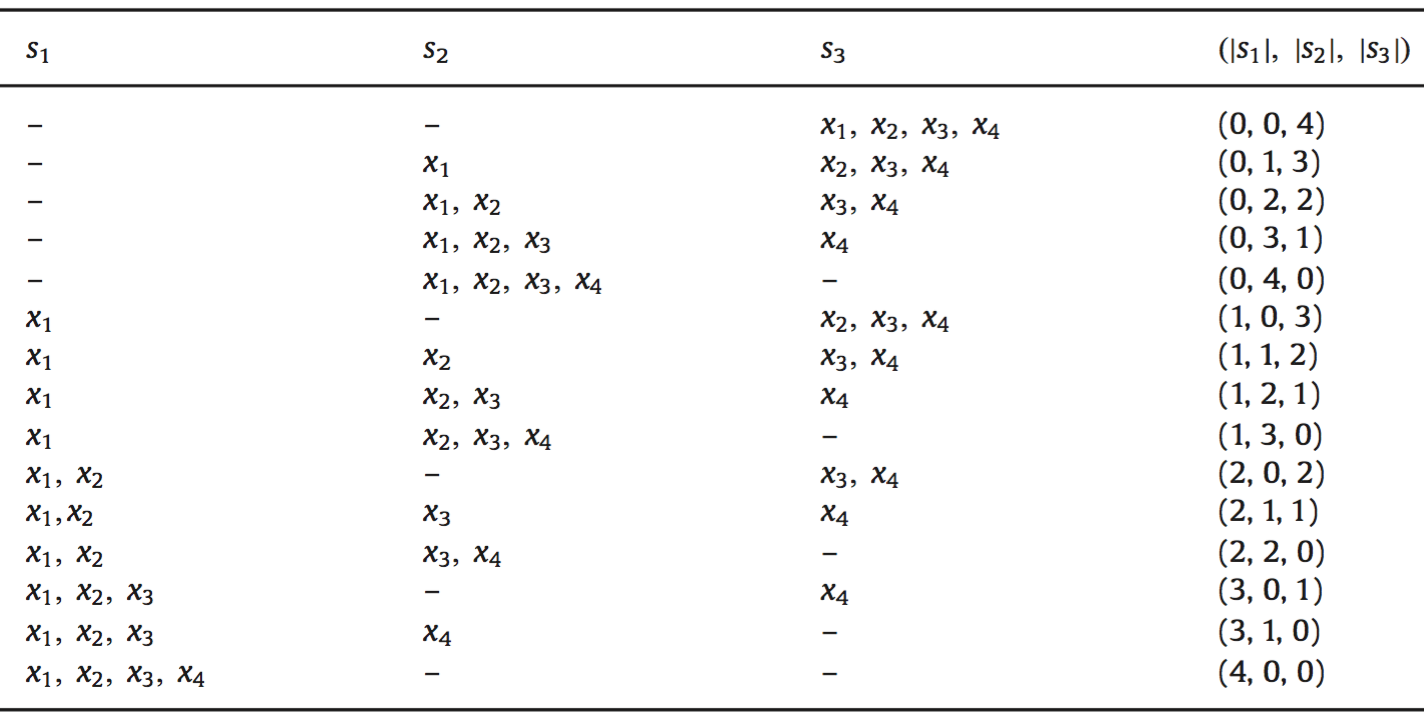
**WIA1002/WIB1002/WXES1117 : Data Structures**

**Tutorial 3 : Recursion (Applications)**

In information theory, one of the most important topics is data representation. Some of the representative examples of using bitstring for data representation are ASCII for character and IEEE-754 for floating point number. We can also use arrangement of items to represent data. For example, suppose there are items (think about apples if it helps) and baskets. Here, the relative order of all items must be preserved. There are exactly 15 ways to group 4 items (denoted by and ) into 3 baskets ( and ) as shown below, and each arrangement can be associated to some value / character / symbol / etc.



\*\* The relative order of the items must be preserved. Given , then for and .

1. Find the values for and in Table 1.

Table 1. The number of possible arrangements given and

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| s / t | #baskets = 1 | 2 | 3 | 4 | 5 |
| #items = 1 | 1 | 2 | 3 | 4 | 5 |
| 2 | 1 | 3 |  |  |  |
| 3 | 1 |  | 10 | 20 | 35 |
| 4 | 1 | 5 | 15 | 35 | 70 |

\*Hint:

- When there is only one basket (), there is only one way to arrange the items.

- When there is only one item (i.e., ), there are exactly possible arrangements.

1. By studying at the values in the table, write the recurrence equation that governs the number of arrangements , and .

\* Hint: Recall that If we let , then .

1. Based on recurrence equation found in part (b), find , … , …, by using MS Excel, viz., expand Table 1 up to and .