# CMPE 300 ANALYSIS OF ALGORITHMS

# PROJECT 3 - ANSWERS

## PART 1

### d) (You can adjust the length of the tables)

#### Success, n=6

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [3] | [0, 1, 5] |
| 2 | [3, 0] | [2, 4] |
| 3 | [3, 0, 4] | [1] |
| 4 | [3, 0, 4, 1] | [5] |
| 5 | [3, 0, 4, 1, 5] | [2] |
| 6 | [3, 0, 4, 1, 5, 2] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 |  |  |  | x |  |  |
| 1 | x |  |  |  |  |  |
| 2 |  |  |  |  | **x** |  |
| 3 |  | **x** |  |  |  |  |
| 4 |  |  |  |  |  | **x** |
| 5 |  |  | **x** |  |  |  |

#### Success, n=6

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [2] | [0, 4, 5] |
| 2 | [2, 5] | [1, 3] |
| 3 | [2, 5, 1] | [4] |
| 4 | [2, 5, 1, 4] | [0] |
| 5 | [2, 5, 1, 4, 0] | [3] |
| 6 | [2, 5, 1, 4, 0, 3] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 |  |  | x |  |  |  |
| 1 |  |  |  |  |  | **x** |
| 2 |  | **x** |  |  |  |  |
| 3 |  |  |  |  | **x** |  |
| 4 | x |  |  |  |  |  |
| 5 |  |  |  | **x** |  |  |

#### Failure, n=6

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [1] | [3, 4, 5] |
| 2 | [1, 4] | [0, 2] |
| 3 | [1, 4, 0] | [3, 5] |
| 4 | [1, 4, 0, 5] | [3] |
| 5 | [1, 4, 0, 5, 3] | [] |
|  |  |  |
|  |  |  |

#### Failure, n=6

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [2] | [0, 4, 5] |
| 2 | [2, 0] | [3, 5] |
| 3 | [2, 0, 5] | [1, 3] |
| 4 | [2, 0, 5, 3] | [1] |
| 5 | [2, 0, 5, 3, 1] | [] |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

#### Success, n=8

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [3] | [0, 1, 5, 6, 7] |
| 2 | [3, 1] | [4, 6, 7] |
| 3 | [3, 1, 6] | [2, 4] |
| 4 | [3, 1, 6, 4] | [0, 2] |
| 5 | [3, 1, 6, 4, 0] | [7] |
| 6 | [3, 1, 6, 4, 0, 7] | [5] |
| 7 | [3, 1, 6, 4, 0, 7, 5] | [2] |
| 8 | [3, 1, 6, 4, 0, 7, 5, 2] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 |  |  |  | x |  |  |  |  |
| 1 |  | **X** |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  | **x** |  |
| 3 |  |  |  |  | **x** |  |  |  |
| 4 | X |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  | **x** |
| 6 |  |  |  |  |  | **x** |  |  |
| 7 |  |  | **x** |  |  |  |  |  |

#### Success, n=8

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [5] | [0, 1, 2, 3, 7] |
| 2 | [5, 2] | [0, 4, 6] |
| 3 | [5, 2, 0] | [3, 6, 7] |
| 4 | [5, 2, 0, 7] | [3, 4] |
| 5 | [5, 2, 0, 7, 3] | [1] |
| 6 | [5, 2, 0, 7, 3, 1] | [6] |
| 7 | [5, 2, 0, 7, 3, 1, 6] | [4] |
| 8 | [5, 2, 0, 7, 3, 1, 6, 4] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 |  |  |  |  |  | x |  |  |
| 1 |  |  | **x** |  |  |  |  |  |
| 2 | x |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  | **x** |
| 4 |  |  |  | **x** |  |  |  |  |
| 5 |  | **x** |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  | **x** |  |
| 7 |  |  |  |  | **x** |  |  |  |

#### Failure, n=8

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [5] | [0, 1, 2, 3, 7] |
| 2 | [5, 0] | [2, 4, 6] |
| 3 | [5, 0, 2] | [4, 6, 7] |
| 4 | [5, 0, 2, 7] | [] |
|  |  |  |
|  |  |  |
|  |  |  |

#### Failure, n=8

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [7] | [0, 1, 2, 3, 4, 5] |
| 2 | [7, 3] | [0, 1, 6] |
| 3 | [7, 3, 1] | [6] |
| 4 | [7, 3, 1, 6] | [2, 4] |
| 5 | [7, 3, 1, 6, 2] | [0, 5] |
| 6 | [7, 3, 1, 6, 2, 5] | [] |
|  |  |  |

#### Success, n=10

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [6] | [0, 1, 2, 3, 4, 8, 9] |
| 2 | [6, 8] | [0, 1, 2, 3, 5] |
| 3 | [6, 8, 5] | [0, 1, 2, 7] |
| 4 | [6, 8, 5, 2] | [0, 4, 9] |
| 5 | [6, 8, 5, 2, 0] | [3, 7, 9] |
| 6 | [6, 8, 5, 2, 0, 7] | [4] |
| 7 | [6, 8, 5, 2, 0, 7, 4] | [1] |
| 8 | [6, 8, 5, 2, 0, 7, 4, 1] | [3, 9] |
| 9 | [6, 8, 5, 2, 0, 7, 4, 1, 3] | [9] |
| 10 | [6, 8, 5, 2, 0, 7, 4, 1, 3, 9] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 |  |  |  |  |  |  | x |  |  |  |
| 1 |  |  |  |  |  |  |  |  | **x** |  |
| 2 |  |  |  |  |  | **x** |  |  |  |  |
| 3 |  |  | **x** |  |  |  |  |  |  |  |
| 4 | x |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  | **x** |  |  |
| 6 |  |  |  |  | **x** |  |  |  |  |  |
| 7 |  | **x** |  |  |  |  |  |  |  |  |
| 8 |  |  |  | **x** |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  |  | **x** |

#### Success, n=10

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [9] | [0, 1, 2, 3, 4, 5, 6, 7] |
| 2 | [9, 2] | [0, 4, 5, 6, 8] |
| 3 | [9, 2, 4] | [1, 7, 8] |
| 4 | [9, 2, 4, 1] | [3, 7, 8] |
| 5 | [9, 2, 4, 1, 7] | [0, 5] |
| 6 | [9, 2, 4, 1, 7, 0] | [6] |
| 7 | [9, 2, 4, 1, 7, 0, 6] | [3] |
| 8 | [9, 2, 4, 1, 7, 0, 6, 3] | [5] |
| 9 | [9, 2, 4, 1, 7, 0, 6, 3, 5] | [8] |
| 10 | [9, 2, 4, 1, 7, 0, 6, 3, 5, 8] | [] |

#### Visualization of the table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 |  |  |  |  |  |  |  |  |  | x |
| 1 |  |  | **x** |  |  |  |  |  |  |  |
| 2 |  |  |  |  | **x** |  |  |  |  |  |
| 3 |  | **x** |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  | **x** |  |  |
| 5 | x |  |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  | **x** |  |  |  |
| 7 |  |  |  | **x** |  |  |  |  |  |  |
| 8 |  |  |  |  |  | **x** |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  | **x** |  |

#### Failure, n=10

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [0] | [2, 3, 4, 5, 6, 7, 8, 9] |
| 2 | [0, 8] | [1, 3, 4, 5, 6] |
| 3 | [0, 8, 4] | [1, 2, 7, 9] |
| 4 | [0, 8, 4, 2] | [7, 9] |
| 5 | [0, 8, 4, 2, 7] | [3, 9] |
| 6 | [0, 8, 4, 2, 7, 9] | [1] |
| 7 | [0, 8, 4, 2, 7, 9, 1] | [3, 5] |
| 8 | [0, 8, 4, 2, 7, 9, 1, 3] | [5] |
| 9 | [0, 8, 4, 2, 7, 9, 1, 3, 5] | [] |
|  |  |  |
|  |  |  |
|  |  |  |

#### Failure, n=10

|  |  |  |
| --- | --- | --- |
| Step | Columns | Available |
| 1 | [5] | [0, 1, 2, 3, 7, 8, 9] |
| 2 | [5, 2] | [0, 4, 6, 8, 9] |
| 3 | [5, 2, 0] | [3, 6, 7, 9] |
| 4 | [5, 2, 0, 3] | [6, 7, 8] |
| 5 | [5, 2, 0, 3, 7] | [4, 9] |
| 6 | [5, 2, 0, 3, 7, 4] | [1, 8] |
| 7 | [5, 2, 0, 3, 7, 4, 8] | [1] |
| 8 | [5, 2, 0, 3, 7, 4, 8, 1] | [] |
|  |  |  |

### d)

|  |  |  |  |
| --- | --- | --- | --- |
| n | Number of Success | Number of Trials | Probability |
| 6 | 683 | 10000 | 0.0683 |
| 8 | 1246 | 10000 | 0.1246 |
| 10 | 631 | 10000 | 0.0631 |

## PART 2

### c)

#### n = 6

|  |  |  |  |
| --- | --- | --- | --- |
| k | Number of Success | Number of Trials | Probability |
| 0 | 10000 | 10000 | 1.0 |
| 1 | 6747 | 10000 | 0.6747 |
| 2 | 2173 | 10000 | 0.2173 |
| 3 | 1082 | 10000 | 0.1082 |
| 4 | 851 | 10000 | 0.0851 |
| 5 | 847 | 10000 | 0.0847 |

#### n = 8

|  |  |  |  |
| --- | --- | --- | --- |
| k | Number of Success | Number of Trials | Probability |
| 0 | 10000 | 10000 | 1.0 |
| 1 | 10000 | 10000 | 1.0 |
| 2 | 8797 | 10000 | 0.8797 |
| 3 | 4956 | 10000 | 0.4956 |
| 4 | 2555 | 10000 | 0.255 |
| 5 | 1709 | 10000 | 0.1709 |
| 6 | 1907 | 10000 | 0.1907 |
| 7 | 2998 | 10000 | 0.2998 |

#### n = 10

|  |  |  |  |
| --- | --- | --- | --- |
| k | Number of Success | Number of Trials | Probability |
| 0 | 10000 | 10000 | 1.0 |
| 1 | 10000 | 10000 | 1.0 |
| 2 | 10000 | 10000 | 1.0 |
| 3 | 7979 | 10000 | 0.7979 |
| 4 | 4190 | 10000 | 0.419 |
| 5 | 2016 | 10000 | 0.2016 |
| 6 | 1153 | 10000 | 0.1153 |
| 7 | 896 | 10000 | 0.0896 |
| 8 | 1140 | 10000 | 0.114 |
| 9 | 2073 | 10000 | 0.2073 |

### d) Comments

For n=6 success probability decreases as k increases. Also for all k values the probability is higher compared to the original Las Vegas algorithm.

For n=8, k=0 and k=1 have same probabilities. After k=1, the probability decreases until k=5. After k=5 the probability increases. For all k values the probability is higher compared to the original Las Vegas algorithm.

For n=10; k=0, k=1,k=2 have same probabilities. After k=2 the probability decreases until k = 7 . After k = 7 the probability increases. For all k values the probability is higher compared to the original Las Vegas algorithm.