CSC 226 SUMMER 2018 - SOLUTION
ALGORITHMS AND DATA STRUCTURES II
ASSIGNMENT 4 - WRITTEN
UNIVERSITY OF VICTORIA

1. The table below contains the lengths of the longest common subsequences:

LLCS[][]		L	**U**	**L**	**L**	**A**	**B**	Y	B	A	B	I	**E**	**S**
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0	1
K	0	0	0	0	0	0	0	0	0	0	0	0	0	1
U	0	0	**1**	1	1	1	1	1	1	1	1	1	1	1
L	0	1	1	**2**	2	2	2	2	2	2	2	2	2	2
L	0	1	1	2	**3**	3	3	3	3	3	3	3	3	3
A	0	1	1	2	3	**4**	4	4	4	4	4	4	4	4
N	0	1	1	2	3	4	4	4	4	4	4	4	4	4
D	0	1	1	2	3	4	4	4	4	4	4	4	4	4
B	0	1	1	2	3	4	**5**	5	5	5	5	5	5	5
O	0	1	1	2	3	4	5	5	5	5	5	5	5	5
N	0	1	1	2	3	4	5	5	5	5	5	5	5	5
E	0	1	1	2	3	4	5	5	5	5	5	5	**6**	6
S	0	1	1	2	3	4	5	5	5	5	5	5	6	**7**

So, the longest common subsequence is “ullabes”.

2. What follows is one way of doing it. Most will strictly use the entries in the llcs[][] and that is okay.

```
Algorithm printLCS(Array llcs[][], String x, String y)
    Input: Array of lengths of the longest common subsequences and the two strings
    Output: String s, the lcs of x and y

    n ← x.length()
    m ← y.length()
    String s

    k ← m*n
    i ← n
    j ← m
    while (i > 0 && j > 0) do
       if x[i] = y[j] then
            s[k] = x[i]
            i ← i-1
            j ← j-1
            k ← k-1
       else if llcs[i-1][j] > llcs[i][j-1] then
            i ← i-1
       else
            j ← j-1
    print(s)
```

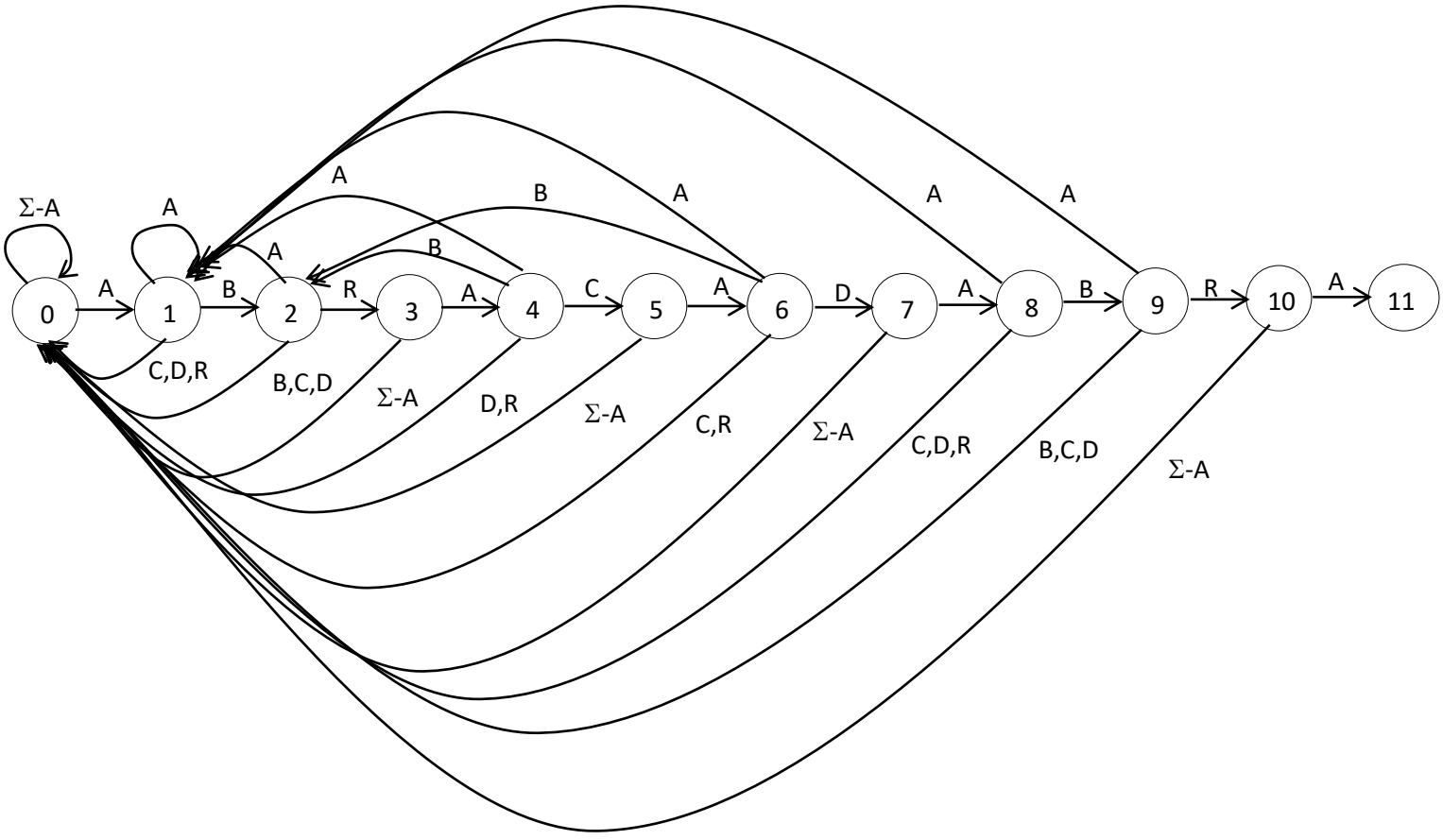
3. (a). The final array is as follows:

right[]	10	8	4	6	9
	A	B	C	D	R

(b). First the array

	j	0	1	2	3	4	5	6	7	8	9	10
pat.charAt(j)		A	B	R	A	C	A	D	A	B	R	A
dfa[][j]	A	1	1	1	4	1	6	1	8	1	1	11
	B	0	2	0	0	2	0	2	0	9	0	0
	C	0	0	0	0	5	0	0	0	0	0	0
	D	0	0	0	0	0	0	7	0	0	0	0
	R	0	0	3	0	0	0	0	0	0	10	0

Transistion diagram – Note Σ-A = B,C,D,R



4. Most will use Boyer-Moore where they will scan the pattern from the right. Whenever there is a mismatch that means they are looking at a nonblank which is not in the pattern, thus they will skip the pattern past the nonblank and start at the end of the pattern again.

   Some will use the brute-force method which actually works well here because you can also do it without backing up in the text when there is a mismatch.

   In both cases it is a O(N) algorithm in the worst-case, but the Boyer-Moore version is O(N/M) in the best-case whereas the others are not.

5. There seems to be two ways to do this, either they ignore the wildcard when hashing, only accounting for it's position or they calculate two hash values, left and right of the wildcard. In both cases there will be some adjustments to the Rabin-Karp algorithm for calculating the rolling hash values.

   They will also have to account for when the wildcard is in position 0 or M-1 as special cases.