

Review 8–3

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Problem 1

Fill in the blanks in the following LCS computation

Solution 1

$c[i][j]$ = The length of an LCS of the subsequences X_i and Y_j .

$$c[i][j] = \begin{cases} 0 & \text{if } i = 0 \text{ or } j = 0 \\ c[i-1][j-1] + 1 & \text{if } i, j > 0 \text{ and } x_i = y_j \\ \max(c[i][j-1], c[i-1][j]) & \text{if } i, j > 0 \text{ and } x_i \neq y_j \end{cases}$$

*	y_j	B	D	C	A	B	A
x_i	0	0	0	0	0	0	0
A	0	↑ 0	↑ 0	↑ 0	↖ 1	← 1	↖ 1
B	0	↖ 1	← 1	← 1	↑ 1	↖ 2	← 2
C	0	↑ 1	↑ 1	↖ 2	← 2	↑ 2	↑ 2
B	0	↖ 1	↑ 1	↑ 2	↑ 2	↖ 3	← 3
D	0	↑ 1	↖ 2	↑ 2	↑ 2	↑ 3	↑ 3
A	0	↑ 1	↑ 2	↑ 2	↖ 3	↑ 3	↖ 4
B	0	↖ 1	↑ 2	↑ 2	↑ 3	↖ 4	↑ 4

Problem 2

Fill in the blanks in the following multiple LCS computation.

Solution 2

$*$	y_j	B	D	C	A	B	A
x_i	0	0	0	0	0	0	0
A	0	$\leftarrow \uparrow 0$	$\leftarrow \uparrow 0$	$\leftarrow \uparrow 0$	$\nearrow \searrow 1$	$\leftarrow 1$	$\nearrow \searrow 1$
B	0	$\nearrow \searrow 1$	$\leftarrow 1$	$\leftarrow 1$	$\leftarrow \uparrow 1$	$\nearrow \searrow 2$	$\leftarrow 2$
C	0	$\uparrow 1$	$\leftarrow \uparrow 1$	$\nearrow \searrow 2$	$\leftarrow 2$	$\leftarrow \uparrow 2$	$\leftarrow \uparrow 2$
B	0	$\nearrow \searrow 1$	$\leftarrow \uparrow 1$	$\uparrow 2$	$\uparrow 2$	$\nearrow \searrow 3$	$\leftarrow 3$
D	0	$\uparrow 1$	$\nearrow \searrow 2$	$\leftarrow \uparrow 2$	$\uparrow 2$	$\uparrow 3$	$\uparrow 3$
A	0	$\uparrow 1$	$\uparrow 2$	$\uparrow 2$	$\nearrow \searrow 3$	$\leftarrow \uparrow 3$	$\nearrow \searrow 4$
B	0	$\nearrow \searrow 1$	$\uparrow 2$	$\leftarrow \uparrow 2$	$\uparrow 3$	$\nearrow \searrow 4$	$\leftarrow \uparrow 4$

Problem 3

Fill in the blanks in the following pseudocode for `LCS-LENGTH`.

Solution 3

```
LCS-LENGTH(X, Y)
  m = X.length
  n = Y.length
  let b[1..m, 1..n] and c[1..m, 1..n] be new tables
  for i = 1 to m
    c[i][0] = 0
  for j = 1 to n
    c[0][j] = 0
  for i = 1 to m
    for j = 1 to n
      if X[i] = Y[j]
        c[i][j] = c[i - 1][j - 1] + 1
        b[i][j] = \nwarrow
      else if c[i-1][j] >= c[i][j-1]
        c[i][j] = c[i-1][j]
        b[i][j] = \uparrow
      else
        c[i][j] = c[i][j-1]
        b[i][j] = \leftarrow
  return c, b
```

Problem 4

Fill in the blanks in the following pseudocode for `PRINT-LCS`.

Solution 4

```
PRINT-LCS(b, X, i, j)
  if i = 0 or j = 0
    return
  if b[i][j] == \nwarrow
    PRINT-LCS(b, X, i-1, j)
    print X[i]
  else if b[i][j] == \uparrow
    PRINT-LCS(b, X, i-1, j)
  else
    PRINT-LCS(b, X, i, j-1)
```