Indian Institute of Technology, Kharagpur
Computer Science and Engineering Department

Autumn 2019-2020
Algorithms II (CS31005)

Note:
You are advised to use LaTeX for document preparation.
wiki link for LaTeX: `https://en.wikibooks.org/wiki/LaTeX`
You can also see `https://www.latex-tutorial.com/tutorials/`
See **LaTeX in Ubuntu** in the next page.

Tutorial Problem 1 [17-07-2019—23-07-2019]

$A[1..m]$ and $B[1..n]$ are two 1D arrays containing m and n integers respectively, where $m \leq n$. We need to construct a *sub-sequence* $C[1..m]$ of B such that $\sum_{i=1}^{m} |A[i] - C[i]|$ is minimized.

1. Develop the recurrences needed for DP, with clear arguments.
2. Design the algorithm and write the pseudo-code.
3. Demonstrate your algorithm on a few input instances.
4. Derive the time and space complexities of your algorithm.

Example

Let $A = \boxed{2}\boxed{7}\boxed{2}$ and $B = \boxed{5}\boxed{3}\boxed{6}\boxed{8}$.

Possible cases:

1. $C = \boxed{3}\boxed{6}\boxed{8}$
   $A = \boxed{2}\boxed{7}\boxed{2}$
   sum $= 1 + 1 + 6 = 8$.
2. $C = \boxed{5}\boxed{6}\boxed{8}$
   $A = \boxed{2}\boxed{7}\boxed{2}$
   sum $= 3 + 1 + 6 = 10$.
3. $C = \boxed{5}\boxed{3}\boxed{8}$
   $A = \boxed{2}\boxed{7}\boxed{2}$
   sum $= 3 + 4 + 6 = 13$.
4. $C = \boxed{5}\boxed{3}\boxed{6}$
   $A = \boxed{2}\boxed{7}\boxed{2}$
   sum $= 3 + 4 + 4 = 11$.

So, here the solution is $C = \boxed{3}\boxed{6}\boxed{8}$.

LaTeX in Ubuntu

1. To install LaTeX in Ubuntu, use the following command:
   `sudo apt-get install texlive-full`

2. Open an editor like `gedit` or `kile`.

3. Create a file using that editor, say with the name `a.tex`, with the following content.

```
\documentclass{article}
\title{Tutorial 1}
\date{17-07-2019}
\author{Your name (and roll number)}

\begin{document}
  \maketitle

  \section{Problem Statement}
    $A[1..m]$ and $B[1..n]$ are two 1D arrays containing $m$ and $n$ integers
    respectively, where $m\le n$.
    We need to construct a sub-array $C[1..m]$ of $B$ such that
    $\sum\limits_{i=1}^{m} \big|A[i]-C[i]\big|$ is minimized.

  \section{Recurrences}

    Text ..........

  \section{Algorithm}

    Text ..........

  \section{Demonstration}

    Text ..........

  \section{Time and space complexities}

    Text ..........

\end{document}
```

4. Compilation command: `pdflatex a.tex`
   It will create the output file named `a.pdf`.

5. Open `a.pdf` in some pdf viewer.
   It will look as shown in the next page!

a.pdf

Tutorial 1

Your name (and roll number)

17-07-2019

1 Problem Statement

$A[1..m]$ and $B[1..n]$ are two 1D arrays containing m and n integers respectively, where $m \leq n$. We need to construct a sub-array $C[1..m]$ of B such that $\sum_{i=1}^{m} \left|A[i] - C[i]\right|$ is minimized.

2 Recurrences

Text .....

3 Algorithm

Text .....

4 Demonstration

Text .....

5 Time and space complexities

Text .....