



TPT1201 Research Methodology

Lab 3

Objectives:

By completing the exercises, you should be able to:

- create mathematical Formulae
- create simple mathematical equations

Exercise 1(Mathematical Symbols)

- (a) Requirement for mathematical typesetting. You need to include `\usepackage{amsmath}` at the preamble section. Create a new tex file with the following codes:

```
\documentclass[a4paper, 10pt]{article}
\usepackage{amsmath}
\begin{document}
$c$ equals $a$ plus $b$. Mathematically,
it is presented as

$$c = a + b.$$

\end{document}
```

You should see the following result:

$$c = a + b$$

- (b) Exercise 2(Simple Equation). Try the following codes for create a simple formulae:

```
\begin{equation}
a^2+b^2=c^2
\end{equation}
```

You should see the following result:

$$a^2 + b^2 = c^2 \quad (1)$$

write another set of codes as follow:

```
\begin{equation}
x^3+y^3=z^3
\end{equation}
```

You should see the following result:

$$x^3 + y^3 = z^3 \quad (2)$$

[note: the second equation has been set to number (2) automatically]

Exercise 2(Mathematical equations)

(a) Experiment with the **IEEEeqnarray** environment:

$$\begin{aligned} a &= b + c & (3) \\ &= d + e + f + g + h + i + j + k \\ &\quad + l + m + n & (4) \\ &= p + q + r + s & (5) \end{aligned}$$

The above example can be produced by the following codes:

```
\begin{IEEEeqnarray}{rCl}
a &= & b+c \\
&= & d+e+f+g+h+i+j+k \nonumber \\
&& +\; l+m+n \\
&= & p+q+r+s \\
\end{IEEEeqnarray}
```

[Note: You must ensure that you have `\usepackage[retainorgcmds]{IEEEtrantools}` in the preamble section. In addition, you must download the **IEEEtranstool.sty** and place it in the same folder where you keep your tex file.]

(b) Typing arrays and matrices

```
\begin{equation*}
\mathbf{X}= \left(
\begin{array}{ccc}
x_1 & x_2 & \ldots \\
x_3 & x_4 & \ldots \\
\vdots & \vdots & \ddots
\end{array}
\right)
\end{equation*}
```

You should see the following result:

$$\mathbf{X} = \begin{pmatrix} x_1 & x_2 & \dots \\ x_3 & x_4 & \dots \\ \vdots & \vdots & \ddots \end{pmatrix}$$

(c) Typing piecewise functions

```
\begin{equation*}
  x = \left\{
    \begin{array}{rl}
      -x & \text{if } x < 0, \\
      0 & \text{if } x = 0, \\
      x & \text{if } x > 0.
    \end{array}
  \right.
\end{equation*}
```

You should see the following result:

$$x = \begin{cases} -x & \text{if } x < 0, \\ 0 & \text{if } x = 0, \\ x & \text{if } x > 0. \end{cases}$$

(d) Typing fraction

```
\begin{equation*}
P = \frac{1}{3} \times \frac{x}{y^2}
\end{equation*}
```

You should see the following result:

$$P = \frac{1}{3} \times \frac{x}{y^2}$$

(e) Typing \sum and \prod

```
\begin{equation*}
X = \sum_{i=1}^n (x^2 - x)
\end{equation*}

\begin{equation*}
Y = \left[ \prod_{i=1}^n (X|x_n) \right]^{\frac{1}{2}}
\end{equation*}
```

You should see the following result:

$$X = \sum_{i=1}^n (x^2 - x)$$
$$Y = \left[\prod_{i=1}^n (X|x_n) \right]^{\frac{1}{2}}$$

(f) Math Fonts

```
$\mathrm{ABCDE \quad abcde \quad 12345}$ \\
$\mathit{ABCDE \quad abcde \quad 12345}$ \\
$\mathnormal{ABCDE \quad abcde \quad 12345}$ \\
$\mathcal{ABCDE \quad abcde \quad 12345}$
```

You should see the following result:

ABCDE	abcde	12345
<i>ABCDE</i>	<i>abcde</i>	<i>12345</i>
\mathcal{ABCDE}	\mathcal{abcde}	$\mathcal{12345}$
\mathbb{ABCDE}	\mathbb{abcde}	$\infty\in\exists\Delta\nabla$

Exercise 3(Writing Algorithms)

You may now create a new tex file. In the **preamble** section, include two packages namely, `\usepackage{algorithm}` and `\usepackage{algpseudocode}`.

(a) Example 1

```
\documentclass{article}
\usepackage{algorithm}
\usepackage{algpseudocode}
\begin{document}
\begin{algorithm}
\caption{MyTestingProcedure}
\begin{algorithmic}[1]
\Procedure {MyTestingProcedure}{$G$, $p$}
\If {$p \geq G$}
\State $p \leftarrow G$
\Else
\If {$p+k \leq G$}
\State $G \leftarrow p+k$
\EndIf
\EndIf
\EndProcedure
\end{algorithmic}
\end{algorithm}
\end{document}
```

Algorithm 1 MyTestingProcedure

```
1: procedure MYTESTINGPROCEDURE( $G, p$ )
2:   if  $p \geq G$  then
3:      $p \leftarrow G$ 
4:   else
5:     if  $p + k \leq G$  then
6:        $G \leftarrow p + k$ 
7:     end if
8:   end if
9: end procedure
```

(b) Example 2. Add a new procedure after the procedure in Example 1.

```
\begin{algorithm}
\caption{FindPathBK}
\begin{algorithmic}[1]
\Procedure {FindPathBK}{ $v$ ,  $u$ ,  $p$ }
\If { $v = u$ }
\State \textbf{Write}  $v$ 
\Else
\State  $w \leftarrow v$ 
\While { $w \neq u$ }
\State \textbf{Write}  $w$ 
\State  $w \leftarrow p(w)$ 
\EndWhile
\EndIf
\EndProcedure
\end{algorithmic}
\end{algorithm}
```

Algorithm 2 FindPathBK

```
1: procedure FINDPATHBK( $v, u, p$ )
2:   if  $v = u$  then
3:     Write  $v$ 
4:   else
5:      $w \leftarrow v$ 
6:     while  $w \neq u$  do
7:       Write  $w$ 
8:        $w \leftarrow p(w)$ 
9:     end while
10:  end if
11: end procedure
```

For more information about writing algorithm in L^AT_EX format, please refer to the following url:
<http://www.tug.org/texlive/Contents/live/texmf-dist/doc/latex/algorithmicx/algorithmicx.pdf>