MATLAB Handout # 3  

Logical operators, loops and if/else statements

This handout describes: (i) logical operators; (ii) the structure of loops; (iii) conditional execution of commands using \textit{if} and \textit{else} statements.

\textit{(i) Logical operators:}

There are three logical operators:

\begin{itemize}
    \item \& denoting \textit{and} \\
    \item | denoting \textit{or} \\
    \item ~ denoting \textit{not}.
\end{itemize}

An expression is true using the \textit{and} operator, \&, if both operands are logically true, e.g. if \(a=1, b=1\) then \(a==1 \& b==1\) is true but \(a==1 \& b==2\) is false. Execute both these commands. Note that the first yields an answer of one, as it is true, and the second yields an answer of zero as it is false. Also note that within logical statements equality is indicated by \(==\).

An expression is true using the \textit{or} operator, |, if either or both operands are logically true, e.g. if \(a=1, b=1\) then \(a==1 | b==1\) is true, \(a==1 | b==2\) is true, but \(a==2 | b==2\) is false. Execute these commands and verify that the answers are what you would expect.

An expression is true using the \textit{not} operator, ~, if the original statement is false, \textit{e.g.} if \(a=1\) then \(~(a==1)\) is true, but \(~(a==2)\) is false. (Note that \(~(a==1)\), for example, can equivalently be written as \(a \sim=1\).) Execute both commands and check the output.

These can be used in conditional execution statements (see (iii) below) or with vectors in which case the statement is whether or not the elements are zero. To illustrate, execute the following commands:

```matlab
a=[1 2 0];
b=[0 1 2];
a & b
a | b
~a
```

In each case the output of the last three commands is a vector whose elements are one or zero. A one in the \textit{i}th element of the output vector indicates in the first two cases that the statement is true about the \textit{i}th elements of \textit{a} and \textit{b} and in the third case that the statement is true about the
ith element of a.

(ii) Loops:
Loops are executed in MATLAB using the for and end statements. To illustrate execute the following commands:

```matlab
a=zeros(3,1);
for i=1:3
a(i)=i;
end
```

(iii) Execution of conditional statements:
Sometimes it is desired to execute commands only if some conditioning statement is correct. This can be done using the if, else or elseif statements. To illustrate execute the following commands:

```matlab
c=1;
if c>0
d=0;
end
```

Now execute:

```matlab
c=0;
if c>0
d=0
else d=1;
end
```

Finally execute:

```matlab
c=3;a=2;
if c==0
d=0;
elseif a==1
d=2;
elseif a>1 d=4;
end
```

Notice: Every set of if/then statements concludes with end.