Examples - Lecture 1

Course: Foundations of Numerical Methods

Software: Mathematica 5.0 (so far, may change....)

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Please note:

(a) The program is divided in cells

(b) To initialize the cells: (shift+enter); you should try only in the yellow cells

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If statements

```
(* notes on syntax: Print[] writes something on the screen,
 the semi-colon does not let anything be printed *)
(* initialization of variables *)
a = 1;
b = 3;
(* if statement *)
If[a < b, Print[a], Print[b]]
(* Question: what do I have to do to get 1 on the screen? *)
```

```
1
```

Do statements

```
Do[Print[2 * i], {i, 1, 10}]
(* Question: what do I have to do to get only odd or even numbers,
 or to print this until 20? *)
```

```
2
```

```
4
```

```
6
```

```
8
```

```
10
```

```
12
```

```
14
```

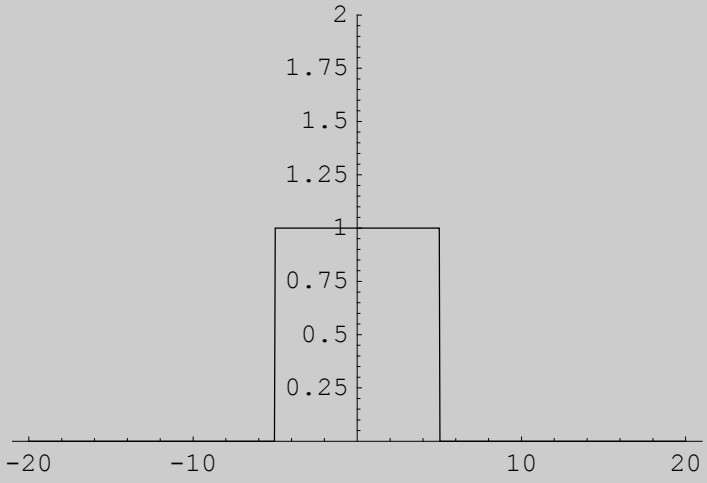
```
16
```

```
18
```

```
20
```

Nested if statements

```
f[x_] := If[x ≤ -5, 0, If[x <= 5, 1, 0]]
(* this plots the function, PlotRange is an option
  which gives the range of the function to be plotted *)
Plot[f[x], {x, -20, 20}, PlotRange → {0, 2}]
```



- Graphics -

Combined if statements/do loops

```
Do[If[i > 5, Print[50], Print[i]], {i, 1, 10}]
```

```
1
```

```
2
```

```
3
```

```
4
```

```
5
```

```
50
```

```
50
```

```
50
```

```
50
```

```
50
```

Truncation error

Comments on Syntax:

(a) Here we used the built-in exponential function

(b) If a do loop involves only a sum, in Mathematica it can be performed in the way below (how about doing it in the standard way?)

```
(* initialization of variables *)
x = 2;
(*built-in exponential function *)
expon = N[Exp[x]]
(* exponential series *)
etest = N[Sum[x^n / (n!), {n, 0, 5}]]
(* absolute and relative errors *)
abserror = Abs[expon - etest]
relerr = Abs[(expon - etest) / expon]
```

```
7.38906
```

```
7.26667
```

```
0.122389
```

```
0.0165636
```

```
x = 2;
expon = N[Exp[x]]
etest = N[Sum[x^n / (n!), {n, 0, 100}]]
abserror = Abs[expon - etest]
relerr = Abs[(expon - etest) / expon]
```

```
7.38906
```

```
7.38906
```

$$8.88178 \times 10^{-16}$$

$$1.20202 \times 10^{-16}$$