

EXAMPLES OF PROGRAMS USING IF STATEMENTS

In lab, we considered two applications of if statements. The first was using an If statement to write out only the non-zero values of the Levi-Civita permutation tensor. Recall that *Mathematica* use the Signature command.

The following line of code will print out only the non-zero terms of ϵ_{ijk} :

```
In[28]:= Do[If[Signature[{i, j, k}] ≠ 0,
    Print["ϵ(", i, ",", j, ",", k, ") = ", Signature[{i, j, k}]]], {i, 3}, {j, 3}, {k, 3}]

ϵ(1,2,3) = 1
ϵ(1,3,2) = -1
ϵ(2,1,3) = -1
ϵ(2,3,1) = 1
ϵ(3,1,2) = 1
ϵ(3,2,1) = -1
```

This code sets up a Do loop that will cycle through all values of the indices i, j, k (each varying from 1 to 3). Inside the Do loop we establish the condition that ϵ_{ijk} is non-zero. If ϵ_{ijk} is non zero, then we print out its value. The ϵ_{ijk} is zero we don't print anything.

Some students tried to write the condition inside the If statement as “if i does not equal j and i does not equal k and j does not equal k , then print the value of Signature”. This sort of logical and can be done in *Mathematica* using &&:

```
In[29]:= Do[If[i ≠ j && i ≠ k && j ≠ k,
    Print["ϵ(", i, ",", j, ",", k, ") = ", Signature[{i, j, k}]]], {i, 3}, {j, 3}, {k, 3}]

ϵ(1,2,3) = 1
ϵ(1,3,2) = -1
ϵ(2,1,3) = -1
ϵ(2,3,1) = 1
ϵ(3,1,2) = 1
ϵ(3,2,1) = -1
```

The second application allows us to write out only those Fibonacci numbers that are prime.

```
In[30]:= Clear[fib]

(* First define a function that will compute the nth Fibonacci number *)
fib[1] = 1; fib[2] = 1;
fib[n_] := fib[n] = fib[n - 1] + fib[n - 2]

(* Now we use an If statement to test whether fib[n] is prime: *)
Do[If[PrimeQ[fib[n]], Print["The ", n,
    " th Fibonacci number is prime and has a value of ", fib[n]]], {n, 1, 100}]
```

The 3 th Fibonacci number is prime and has a value of 2
The 4 th Fibonacci number is prime and has a value of 3
The 5 th Fibonacci number is prime and has a value of 5
The 7 th Fibonacci number is prime and has a value of 13
The 11 th Fibonacci number is prime and has a value of 89
The 13 th Fibonacci number is prime and has a value of 233
The 17 th Fibonacci number is prime and has a value of 1597
The 23 th Fibonacci number is prime and has a value of 28657
The 29 th Fibonacci number is prime and has a value of 514229
The 43 th Fibonacci number is prime and has a value of 433494437
The 47 th Fibonacci number is prime and has a value of 2971215073
The 83 th Fibonacci number is prime and has a value of 99194853094755497