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 $\epsilon_{ijk}$:

```
In[28]:= Do[If[Signature[{i, j, k}] \!\(\neq\) 0, Print["\(\epsilon\)(", i, ",", j, ",", k, ") = ", Signature[{i, j, k}]], {i, 3}, {j, 3}, {k, 3}]
```

$\epsilon(1,2,3) = 1$
$\epsilon(1,3,2) = -1$
$\epsilon(2,1,3) = -1$
$\epsilon(2,3,1) = 1$
$\epsilon(3,1,2) = 1$
$\epsilon(3,2,1) = -1$

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 $\epsilon_{ijk}$ is non-zero. If $\epsilon_{ijk}$ is non-zero, then we print out its value. The $\epsilon_{ijk}$ 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 \!\(\neq\) j \&\& i \!\(\neq\) k \&\& j \!\(\neq\) k, Print["\(\epsilon\)(", i, ",", j, ",", k, ") = ", Signature[{i, j, k}]], {i, 3}, {j, 3}, {k, 3}]
```

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