Submission 3

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1 From Lecture Slides

P 3.1

> *(Bertrand's postulate)* Prove that for every natural $n \leq 1$, there is a prime p such that $n \leq p \leq 2n$.

Solution

I included a draft of my proof in **figure 1**.

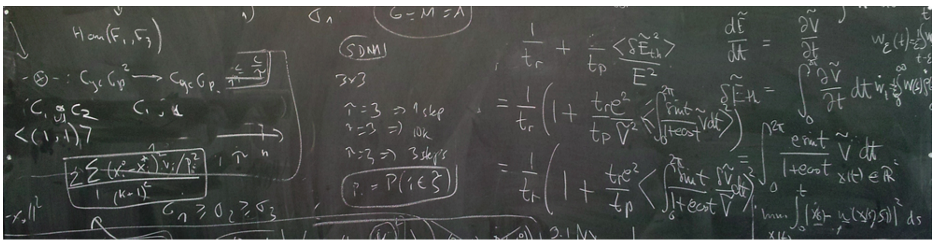

Figure 1: My draft for **P 3.1**

Notes

```python
import numpy as np

def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
    M = None #to become the incidence matrix
    VT = np.zeros((n*m,1), int)  #dummy variable

    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
    M2 = np.triu(bitxormatrix(genl2),1)

    for i in range(m-1):
        for j in range(i+1, m):
            [r,c] = np.where(M2 == M1[i,j])
            for k in range(len(r)):
                VT[(i)*n + r[k]] = 1;
                VT[(i)*n + c[k]] = 1;
                VT[(j)*n + r[k]] = 1;
                VT[(j)*n + c[k]] = 1;

                if M is None:
                    M = np.copy(VT)
                else:
                    M = np.concatenate((M, VT), 1)

                VT = np.zeros((n*m,1), int)

return M
```

Code 1: My pseudocode for **C 3.1**

2 Coding Exercises

C 3.1

> Verify **P 3.1** for $n \leq 50$.

Solution

The code for **C 3.1** is included in my GitHub repository alan-turing/ai. An overview of my algorithm is provided in **Code 1**.

Notes

1. My work was based on the COTAI3 algorithm.
2. Only the cases where $n = 1$ and $n = 2$ were solved.

3 Extra Practice

E 3.1

> Verify **P 3.1** for $n \leq 50$.

Solution

Notes