Facebook Connectivity
Project Draft
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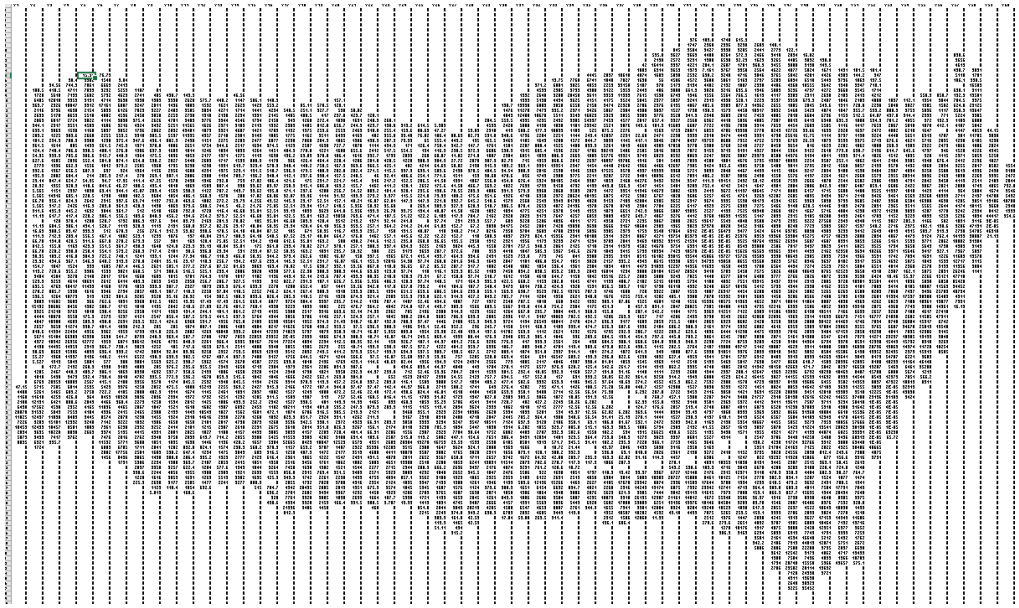
Project Goals

The goal of this project was to determine the optimal locations to place WiFi access points in Ghana to ensure that a certain percentage of the population has WiFi coverage while minimizing the total cost of installing the access points. Formulating this problem as a Mixed Integer Program will allow the optimal locations of the large and small access points to be determined. To represent all the possible locations of the access points in Ghana, the country was divided up into rectangular pixels, in each of which one access point can be placed. It was therefore also necessary to decide how large each pixel should be: smaller pixel sizes allow for greater accuracy but also result in programs that may be too large to solve; larger pixel sizes allow for ;smaller programs and faster solving speed, but accuracy is sacrificed. The final output of the program gives the locations of all of the small and large access points that will be placed in the country and the total cost of installing these access points.

Data Description

A description of the data (and sources) as well as a complete description of the model.

To properly execute the wifi access point project, we must first have suitable data to work with. We highly utilize Columbia University's CISEN (Center for International Earth Science Information Network) website. The website uses a High Resolution Settlement Layer (HRSL) to give us an estimate of the population for 33 regions of the world, both rural and urban. In our analysis, We decided to work with the country of Ghana. To utilize the data from CISEN, we had to take a few steps to make the data from CISEN easy to access in our Julia code. Because the CISEN data in TIFF format, we used an R script made by our teacher assistant Anthony Battista to convert it into a CSV format. We decided to work with the country Ghana. We have two options for the CSV, and we decided on using the Ghana 2 one. The Ghana 2 CSV consists of several excel blocks, roughly in the shape of the country, and gives populations of each of them. Here is what the Ghana excel sheet looks like:



(attach other files)

PSEUDO CODE

Initialize R as array i x j with all 0s
Loop through all points (i,j) in the country
    if S_ij == 1
        loop through all points within a 5km radius of (i,j)
        For each x
            Calc lower y
            Calc upper y
            For lower y to upper y (distance formula)
                Iterate through all the (x,y) from bottom to top
                fill in 2D array R with 1 at these positions (i,j) that are within range
    else if L_ij == 1
        loop through all points within a 15 km radius of (i,j)
            fill in 2D array R with 1 at these positions (i,j) that are within range
n= right hand limit
X-min (use xmin = max(1, i-5))
X-max (use xmax = min(n, i+5)
Same with y

ANTHONY'S SUGGESTION?

<BEGIN>

Iterate through all points (i,j) in the country.
Examine the given point (i,j).

For an access point, check if it is in a specific range within the x-axis first. To do this, Subtract and add the axis point's radius from the coordinate's x-location. If yielding a negative Number, replace it with 0.

Iterate through the working x values within the range. This is trivial for the upper limits of x (moving anymore goes out of range). The feasible regions for y are the y value plus and minus the radius when the x is the original value.
Now, given a list of feasible x and y values, iterate through them to see how many access points Are actually covered.
Set the Rij value.

Analytical Model

[Additional: Sensitivity/Parametric] Analysis

Conclusions

Future Work/improvements

Appendix

```
# either put the code here so it is presented the qualities of code coloration
# or attach a separate notebook *note: possibility for additional credit
# CodeBlocks is the name of the add-on that does this
```