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MSC PHD (OR)

PART (1) and PART(2)

Given that

A={a1,a2,a3,…,an} is the set of symbols that we'll have in the string

A string $s=s_1\ s_2\ s_{3\ldots}\ s_l$ of length l where each character belongs to A

Given $S=\{s^1, s^2,\ldots, s^M\}$

Aim is to find the string $c=c_1\ c_2\ c_3\ c_{4\ldots}\ c_l$ such that $\sum_{m=1}^{M} H(sm, c)$ is minimum.

We can do this by giving each alphabet in A a number(eg 1 , 2 , 3 , 4)

Defining a parameter l where l is the length of each string.

Defining a set STRCH={1,2,3,…,l}.

We give each ai in A a number and let that set of numbers be NUM={1,2,3,…,n}

Defining a matrix named 'string' such that $string_{S*STRCH}$ where each element of the matrix will tell the corresponding number of that charcter of the string , eg $string_{s1,3}$ will tell the number corresponding to the 3rd character of s^1.

An example of 'string' can be:

```
matrix string:
     1   2   3   4   5   6   7   8   9    10:=
s1   2   3   1   1   1   4   4   1   1    4
s2   2   3   3   4   4   4   2   1   4    1
s3   2   2   3   1   2   2   3   2   2    1
s4   2   1   1   4   2   3   2   3   2    1;
```

Now , Defining the decision variables:

Let x{S,STRCH} be variables in [S,STRCH] such that x is binary.

Let c{STRCH} be variables in STRCH such that c is integer.

Defining the objective function:

MINIMIZE $\sum_{i\ in\ S, j\ in\ STRCH}\ x[i,j]$

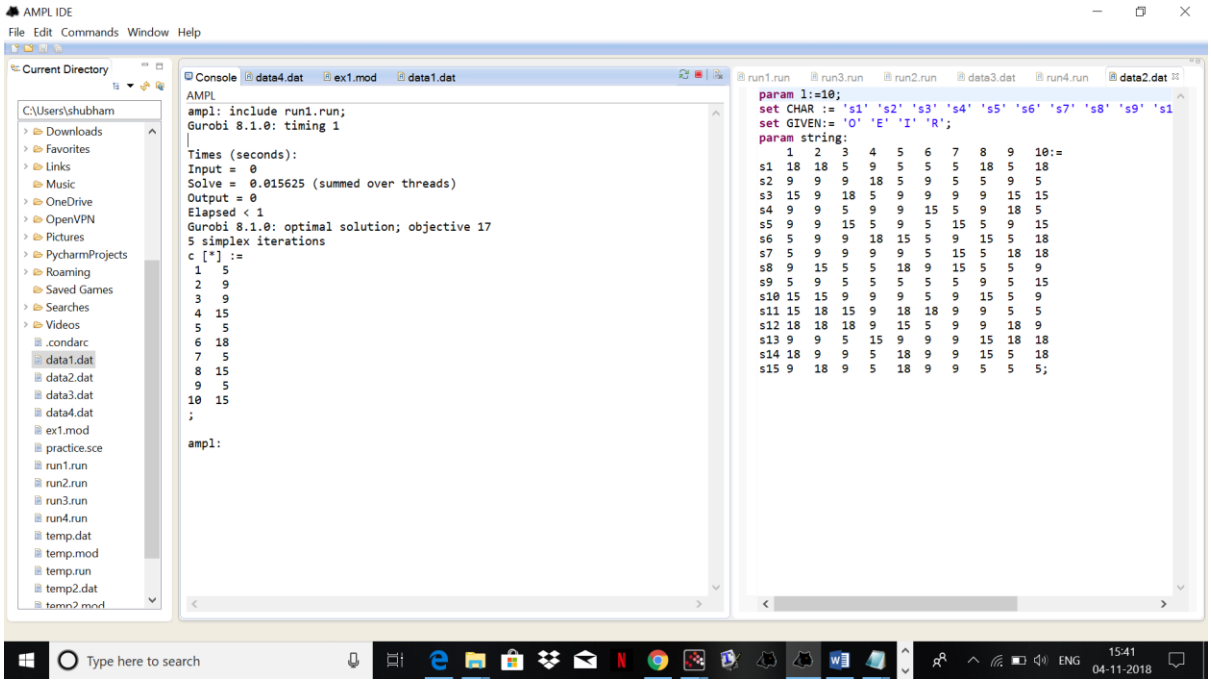
subject to constraints:-

x[i,j] ≥ (c[j]-string[i,j])/50 , for all i in S, j in STRCH.

x[i,j] ≥ -(c[j]-string[i,j])/50 , for all i in S, j in STRCH.

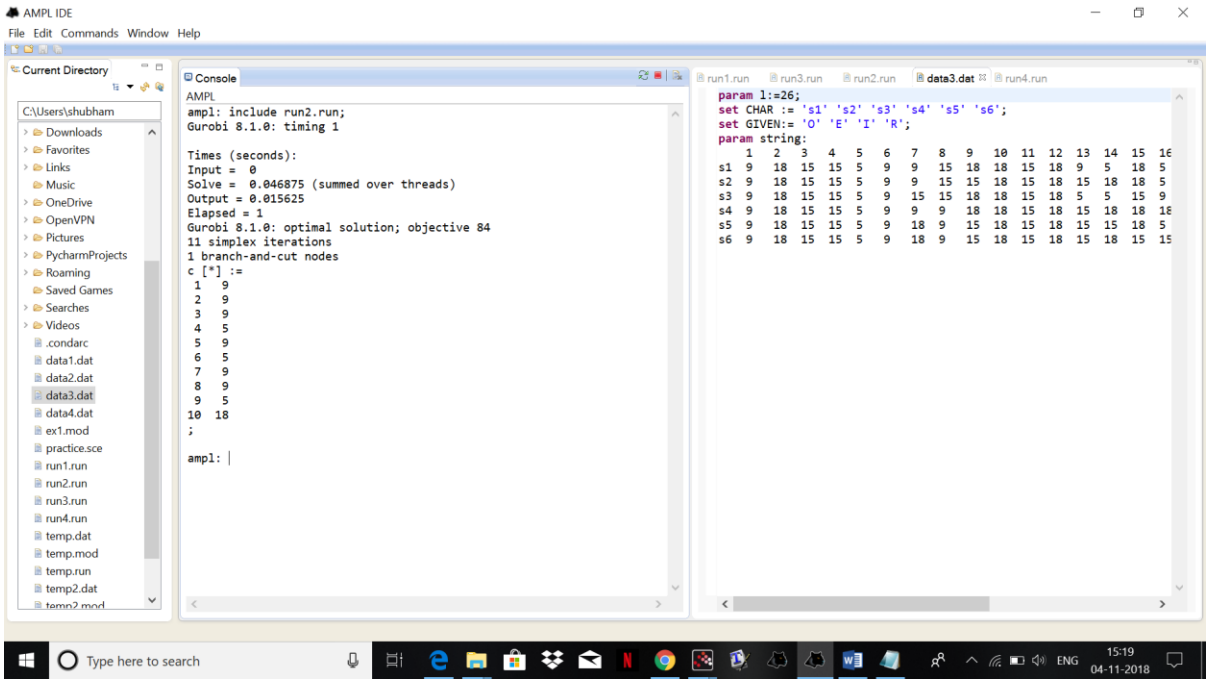
We have formulated the above question as an integer lenear programming problem.In the above problem, we have taken each character of the string to be a number and then made the constraints in such a way that it will give the make a string in such a way that it will minimize $\sum_{m=1}^{M} H(sm, c)$.

PART (3)



The string c is : ‘eiioereoeo’

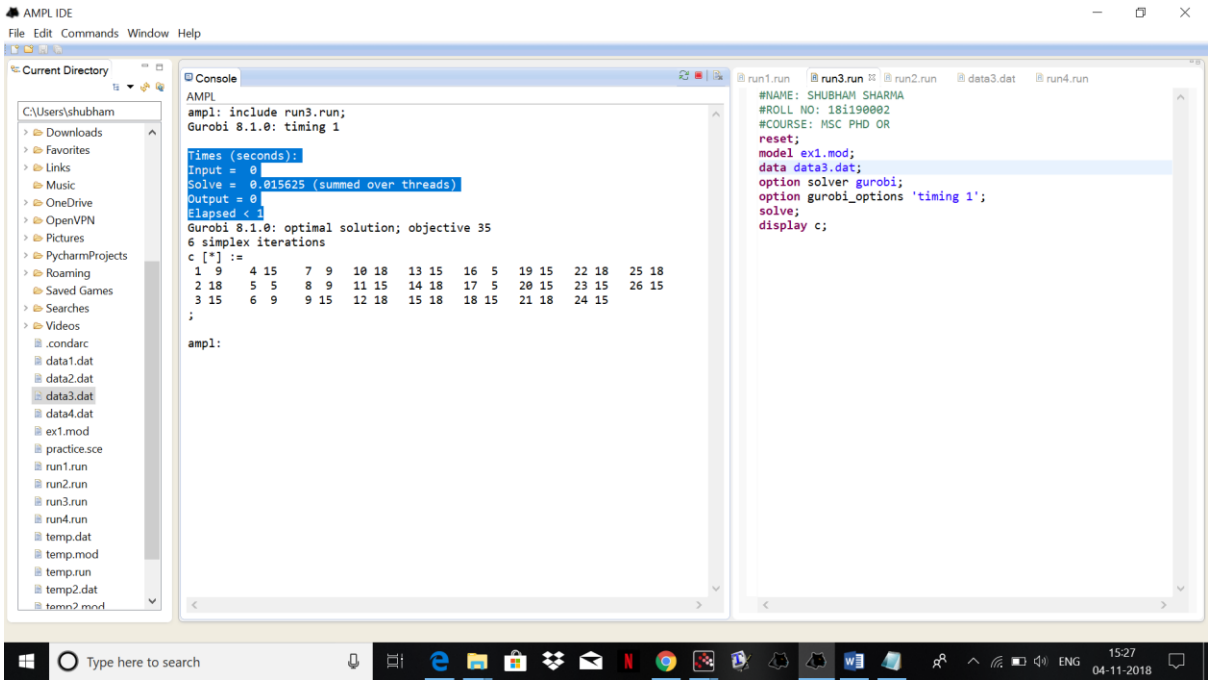
```
Times (seconds):
Input =  0.015625
Solve =  0 (summed over threads)
Output = 0
Elapsed < 1
```



The string c is :'iiieieiier'

```
Times (seconds):
Input =  0
Solve =  0.046875 (summed over threads)
Output = 0.015625
Elapsed = 1
```

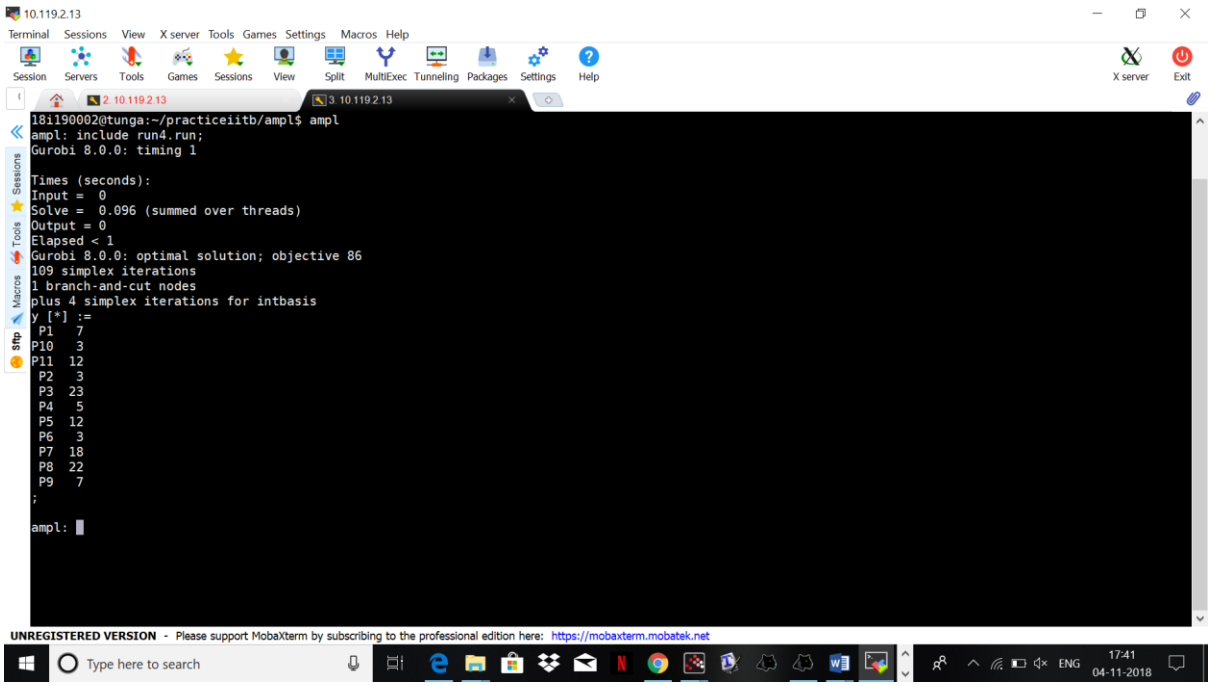
PART (4)



The string c is :'irooeiiiorororoeeooorrooro'

```
Times (seconds):
Input =  0
Solve =  0.015625 (summed over threads)
Output = 0
Elapsed < 1
```

PART (5)



the string c is : ‘gcwelcrvgcl’

Times (seconds):

Input = 0

Solve = 0.096 (summed over threads)

Output = 0

Elapsed < 1

PART (6)

For data 1

cohesiveness=2

For data 2

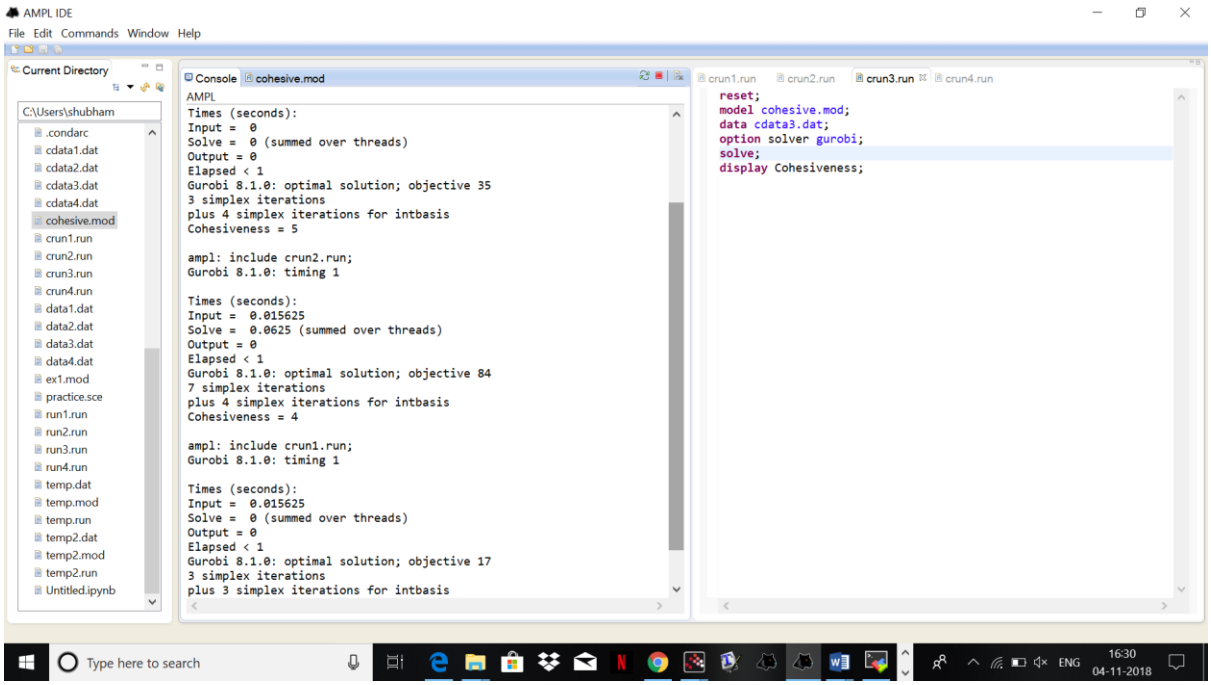
cohesiveness=4

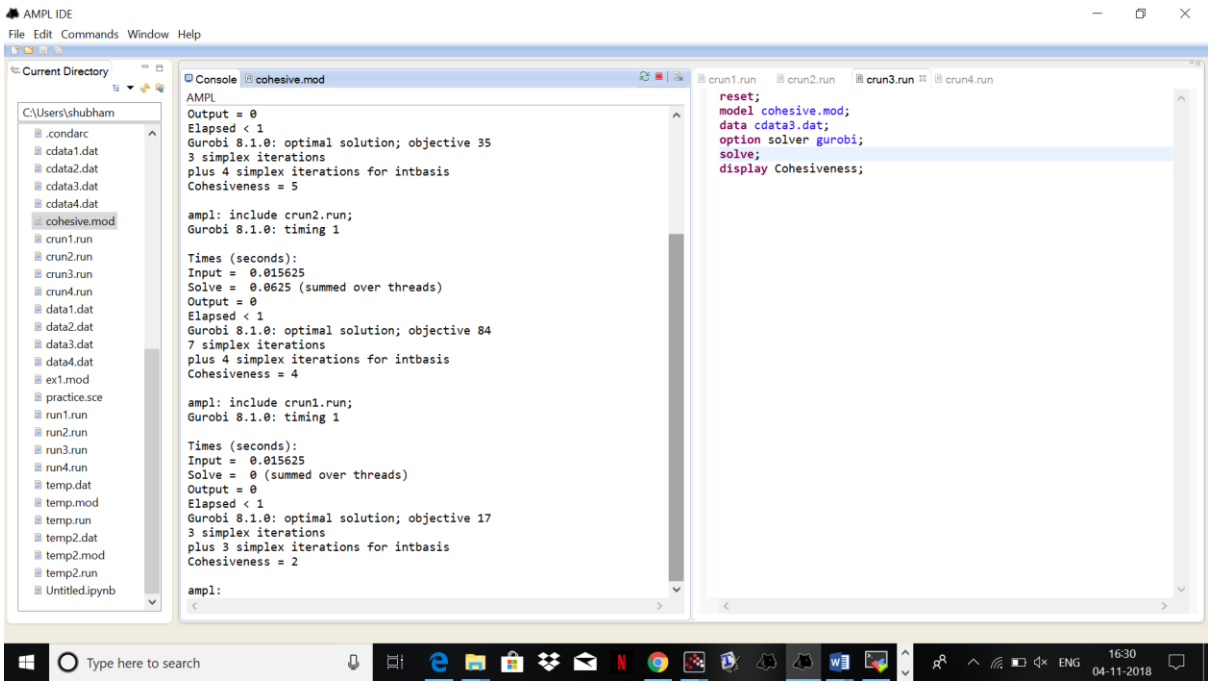
For data 3

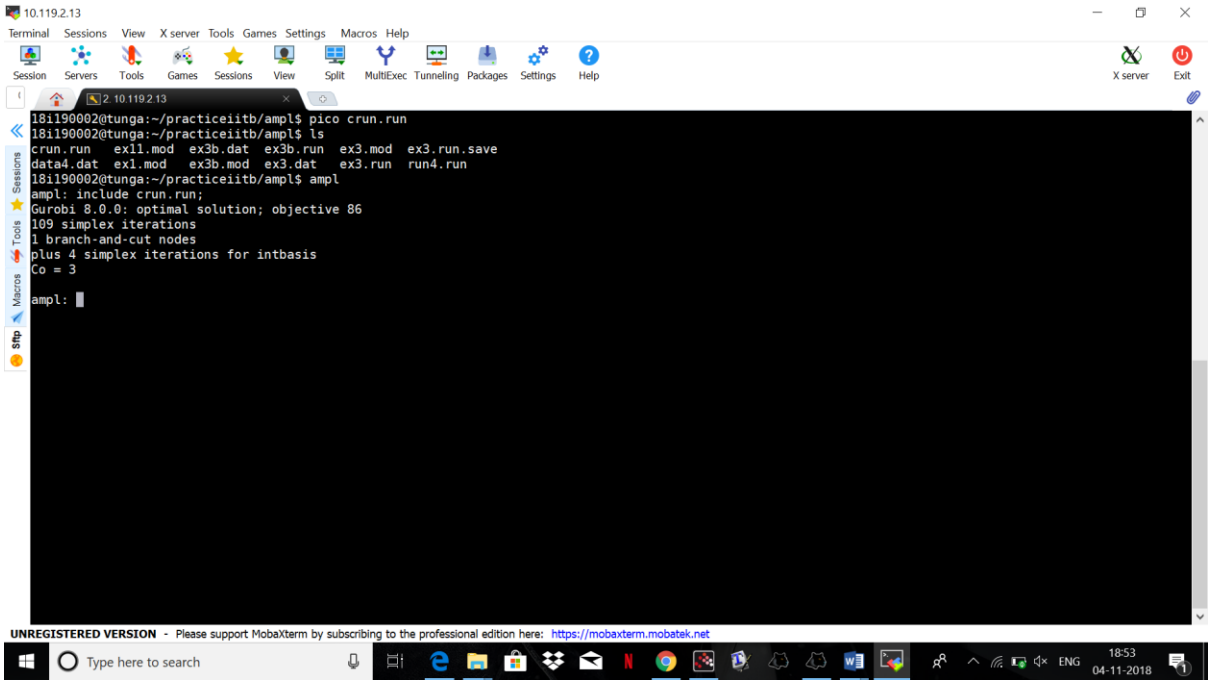
cohesiveness=5

For data 4

Cohessiveness=3







PART (7)

If the objective was to minimize Cohesiveness over all possible l length strings, then we would have made a optimisation model in such a way that it minimises the cohesiveness of all the l length strings that can be made by the given alphabets. We find the max and min of the sum of variables and find the cohesive minimum