In the name of God

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SELECTED TOPICS COURSE

Exercise Set 1

1. General view of Optimization: For the traveling salesman problem, find the optimum route according to the definition in the second page of this exercise.

2. Shell script experiences: write proper shell scripts to do following tasks:
   A : Make a directory for every given python file with its name, and move the file into associated directory. Then run mentioned python file and save the elapsed running time into a file named "time+index" (e.g. for "file2.py" it should be "time2") inside that directory. Then make a list of all times written in a separate file in the given root directory.
   B : Write a proper shell script to print the content of each file inside each directory in order, to clarify the corresponding sentence. Then write the sentences with order same as for directory to a file named "sentence.txt".
   C : Loops.
   D : Making directory and file.
   E : Reading from file and writing in another file.
   F : Run a simple program.

3. Rounding error in computer: Suppose to have single precision for floating point representation. In this case compute $5.5 + 10^{-8} = ?$ (Hint: to this end use floating point representation and then add two representations).

4. Floating point representation:
   A : For Single precision paradigm, compute minimum and maximum values of a positive number (except to "0" and "$+\infty$")
   B : For Double precision paradigm, compute minimum and maximum values of a positive number (except to "0" and "$+\infty$")

5. Suppose that a typical secondary quantity, z is computed by $z = \tanh(x^2) + e^y$. According to data files ("xnew.txt" and "ynew.txt"), determine series for z including corresponding error. Plot all data file. (Hint: each input data file contains 3 columns. The first column is just label, the second column is quantity and third column is error.)

6. Error analysis and propagation: Using the "data.txt" file, write a proper program to do following tasks:
   A : Read input data file which contains more than 10^6 one-column data. and spilt it to 100 input files.
   B : Making directories and send each data set to corresponding directory.
   C : compute the PDF ($p_i(x)$,, $i = 1, ..., 100$) of each data sets using Top-Hat kernel for $\Delta x = 0.1$, $\Delta x = 0.01$ and $\Delta x = 0.001$.
   D : Compute $\sigma_m(p_i(x))$. Plot $p_i(x)$ versus x and show its error-bar for some of data sets.
   E :Then based on smoothing approach, consider $\mathcal{B}(X) = e^{-X^2/2\sigma}$ with $\sigma = 2$, $\sigma = 0.2$ in order to smooth PDF. Explain you results.
   E : Compute $p(x(i), x(j))$ and compare it with each one-point probability density function by determining $\Delta(\tau) = \int dx(t)dx(t+\tau)|p(x(t+\tau), x(t)) - p(x(t+\tau))p(x(t))|$. For 5 arbitrary sets plot $\Delta(\tau)$ as a function of τ. Explain your results.

Good luck, Movahed

TSP Algorithm

1) Set the labels of each city to zero to clarify the times of visit
2) Starting from an arbitrary city
3) Traveling to another unvisited city

This can be done either in deterministic or stochastic approaches

1) For each given starting point select next unvisited destination randomly
2) Check the conditions of our purpose
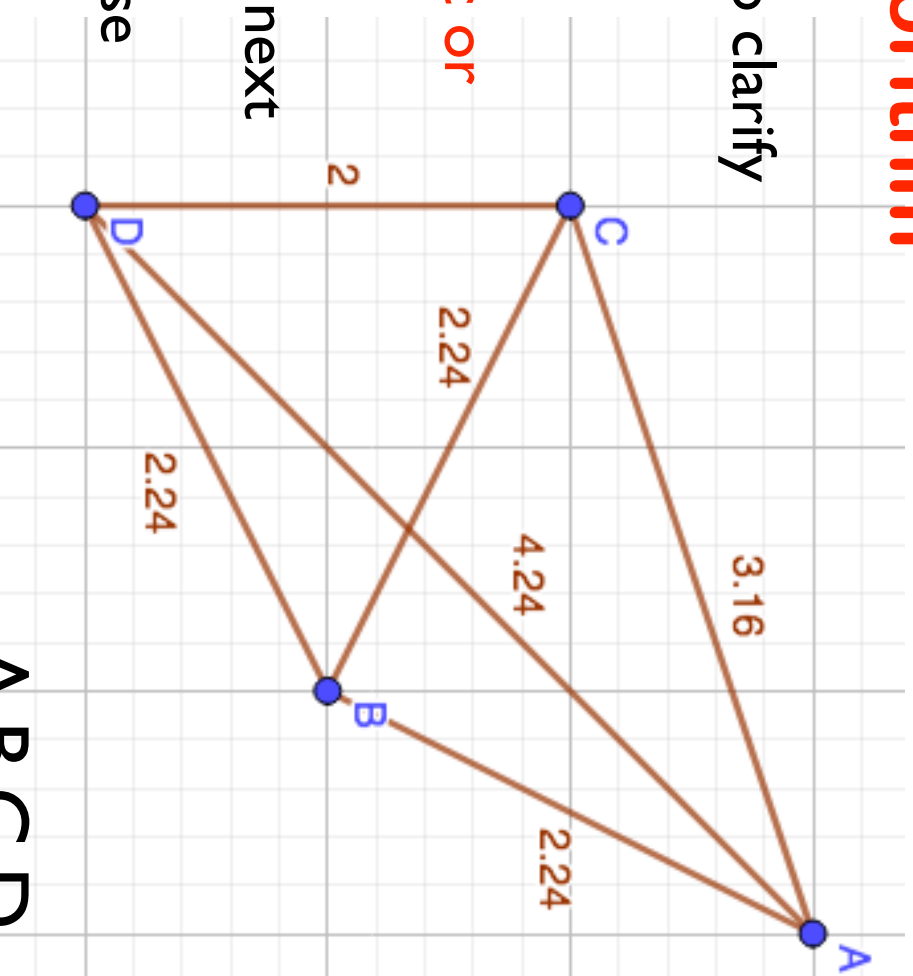
Exercise: Try to solve TSP according to following conditions:

- Visit twice C-City
- Visit necessarily C before D

A,B,C,D
A,B,D,C
C,D,B,A
D,C,B,A