CS 4310 - Algorithms - Fall 2017

HomeWork5

Given: November 21, 2017

Due: December 3, 2017

General Comments: *Show all your work, otherwise no partial credit. No credit without proper justifications. State all your assumptions. No Algorithm is complete without its time and space complexity. When presenting an algorithm, first indicate if it is similar to a well-known algorithm, second describe intuitively how the algorithm works (which may be supported by examples), third give its pseudo code and finally analyze its time and space complexity.* Always describe general idea of the algorithm before giving its pseudo-code. Do not reinvent the wheel, i.e., if a well-known algorithm can be modified to solve a problem efficiently, use that solution and clearly indicate the changes required. Do not unnecessarily complicate a solution, i.e., if a simple but efficient solution exists then we should use it. Finally, if you just write pseudo-code of a well-known algorithm without indicating how it applies or modified to the problem at hand, no credit will be given.

1. Since you should be very comfortable and expert at programming, its easier to write a program for problems 2, 3 and 4 and you are strongly encouraged to do so and submit that. But for practice and better understanding, also *do go through first 5-10 steps* by yourself (i.e., hand-trace the algorithm in question). Writing program is optional but strongly encouraged (its for your own good). Turning in your well-designed code using good programming practices would be worth an extra credit of 20 pts total. Please avoid the temptation to simply copy code from the web! (otherwise the learning objective is defeated, what else?)
2. (20pts) Given a chain of six matrices M1, M2, ..., M6, where matrix Mi is of size r_{i-1} X r_i, with r0=3, r1=35, r2=15, r3=5, r4=10, r5=2 and r6=25. Show all the steps of exceuting the dynamic programming algorithm **as discussed in class** to find the best way to compute the product of the chain. Show the parenthesization as well as the number of operations used ito compute the product.
3. (20pts) Show all the steps of the Floyd-Warshall's dynamic programming algorithm to compute all-pairs shortest paths in the graph in section 2.1 of the linked pdf note. Since the graph is rather large, for hand tracing, prune the graph to first four vertices (i.e., consider the graph with vertices 1,2, 3 and 4 and edges among these vertices with weights as shown). If you are writing a program, then you might as well use the whole graph and see how the algorithm works.
4. (30pts) Consider the following instance of the 0/1 knapsack problem, with knapasack capacity 100

Weights	10	20	30	40	50	
Profits	40	20	90	60	30	

In class we discussed a DP formulation of solving the 0/1 knapsack problem, show all the steps using this formulation on the above instance.

5. (30pts) Recall the RDS problems as discussed in class:
   Given n jobs, each associated with a release time, a deadline, and a processing time on a machine M, is there a non-preemptive feasible schedule on M such that all jobs meet their deadlines?

   For the following three instances of the RDS problem, determine whether there is a feasible schedule. If there is a feasible schedule, clearly indicate the schedule. The lists specify the atributes of jobs in order.
   - n=5, ProcessingTimes={3, 4, 1, 2, 3}, ReleaseTimes={4, 2, 7, 5, 0} and Deadlines={13, 8, 13, 9, 9}.
   - n=5, ProcessingTimes={3, 4, 1, 2, 3}, ReleaseTimes={4, 2, 7, 5, 0} and Deadlines={13, 5, 13, 9, 9}.
   - n=5, ProcessingTimes={3, 4, 1, 2, 5}, ReleaseTimes={9, 2, 7, 5, 0} and Deadlines={12, 8, 13, 9, 9}.

6. MORE PROBLEMS MAY BE ADDED AS WE COVER ADDITIONAL TOPICS - but for your practice

General Instructions on submitting your homeworks.

For programming assignments, submit a SINGLE zipped file of your source codes, scripts (to run your program if any) and a brief report along with a copy of a couple of sample executions of your solution. No need to say, but you should be using good conventions and programming practices in developing your programs [just in case you forgot, refresh them from some of the coding conventions etc links provided on the TopicsCovered page.]

Use <hw#cs5310_yourlastname_mmddyy.{zip,ppt,doc,tex}> as the naming convention for your zipped, ppt, MS-Word, or LaTex files when submitting on Elearning. Replace '#' with the appropriate homework number.

Any student may be asked to show and discuss his or her solution in class, so be ready with your presentation.