

Quiz 24 Standard 24 – DP – Backtracking to find solutions

Due Date TODO
Name **Blake Raphael**
Student ID **109752312**
Quiz Code (enter in Canvas to get access to the LaTeX template) **BSGAA**

Contents

Instructions	1
Honor Code (Make Sure to Virtually Sign)	2
24 Standard 24: Dynamic Programming: Backtracking to find solutions	3

Instructions

- You may either type your work using this template, or you may handwrite your work and embed it as an image in this template. **If you choose to handwrite your work, the image must be legible, and oriented so that we do not have to rotate our screens to grade your work.** We have included some helpful LaTeX commands for including and rotating images commented out near the end of the LaTeX template.
- You should submit your work through the **class Gradescope page** only. Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students. Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.
- You **must** virtually sign the Honor Code (see Section). Failure to do so will result in your assignment not being graded.

Honor Code (Make Sure to Virtually Sign)

Problem HC. • My submission is in my own words and reflects my understanding of the material.

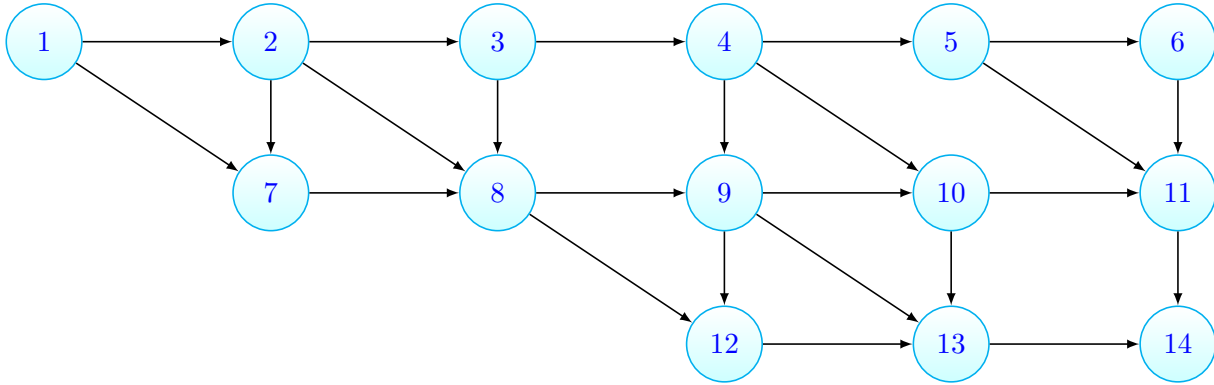
- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

Agreed (I agree to the above, Blake Raphael).

□

24 Standard 24: Dynamic Programming: Backtracking to find solutions

Problem 24. Consider the LONGEST PATH IN A DAG problem on the following directed acyclic graph (the same as in HW8):



The following is the dynamic programming table for the *longest* path from each vertex v to 14:

14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	1	2	1	2	3	4	5	2	3	4	5	6	7

It was arrived at using this recurrence:

$$L[j] = \begin{cases} 0 & j = 14 \\ 1 + \max\{L[k] : (j, k) \in E(G)\} & j < 14 \end{cases}.$$

From the table, **clearly indicate the steps you take to backtrace to find the longest path** $1 \rightarrow 14$. Be sure to indicate what choices you are considering at each step and which choice was chosen.

Answer. Here is the path taken:

1. We start by considering 2 or 7 from node 1. We choose node 2.
2. We then consider nodes 3,7, or 8. We choose node 7.
3. We then consider node 8 and choose node 8.
4. We then consider nodes 9 and 12. We choose node 9.
5. We then consider nodes 10, 12, and 13. We choose node 10.
6. We now consider nodes 11 and 13. We choose node 11.
7. Finally we consider node 14 and choose node 14.

This gives us the following path: $1 \rightarrow 2 \rightarrow 7 \rightarrow 8 \rightarrow 9 \rightarrow 10 \rightarrow 11 \rightarrow 14$ which, by using our recurrence relation, gives us a path length of 7 which is our longest path from $1 \rightarrow 14$.

□