GUI Summer 2019 **07/02/2020**

Final Examination.

Due on 07/03/2020 at 4:00 pm.

Instructions for the final:

1) Show all the details of your work and carefully explain, with significant elaboration, the way you have solved the problems. Failure to comply with this requirement will result in a grade of 0 for the specific question.

2) The final is an open book, notes, and online resources exam.
3) You have to submit your exam using a file that is readable by MS word or by a text editor
4) Write your name on each page you submit.
5) Your exam will be graded for accuracy, precision, and thoroughness not for length
6) **Graduate students have to complete all the parts of the questions including bold font.** Undergraduate students are exempt from bold font parts.
7) The first line in the first page of your submission must be:

I [student name] certify that I have carefully read the instructions for the final.

Where, [student name] is your full name.

Questions

1) (20%) QT OGL Programming

a. Write a Qt & C++ program that defines a scene where the camera is in a view volume which is a rectangle of 2 by 3, by 4 centered around the point $[0, 0, 0, 1]^T$. The camera is located at the point $[0, 0, 1, 1]^T$ and "Looking" at $[0, 0, 0, 1]^T$. You cannot use GLU functions, you can only use GL functions.

b. Write a Qt & C++ program that defines a scene where the camera is in a view volume defined by gluPerspective(45, 1, 1, -1, 1). The camera is located at the point $[0, 0, 0, 1]^T$ and "Looking" at $[0, 1, 0, 1]^T$. You cannot use GLU functions, you can only use GL functions.

2) (total of 50%) Usability Evaluation:

Consider a Web-based video conferencing application like Zoom or WebEx and assume that you are a member of a team that designs this type of application.

a. (10%) Please provide one functional requirement as well as a set of usability requirements for one medium complexity use-case (scenario). The usability requirements should address the learnability, operability, and satisfiability of the system with respect to the selected use case. Please provide one requirement per metric (e.g., one requirement for learnability).

b. (20%) Please provide a test procedure for testing compliance of the planned system with your learnability requirement.

c. (20%) Please provide a pinpoint procedure for testing compliance of the planned system with your operability requirement.

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3) (30%) search in the state space

Consider the following relations (check Figure 1, with reversed arrows for an illustration).

Given a natural number n the Collatz successors of n are defined to be:

$$C(n) = \begin{cases} \{2 \times n, (n-1)/3\} & if\ \ n\ is\ even\ AND\ ((n-1)\ mod\ 3 = 0) \\ \{2 \times n\} & Otherwise \end{cases}$$

Given a natural number n the Collatz state space is the graph $G_n(V, E)$ where V is the set of vertices of G_n, and E is the set of edges of G_n. G_n is constructed by:

1) Set n to be a vertex in V
2) For each vertex $j \in V$ add $C(n)$, the Collatz successor[s] of j, to V.
3) Add edges from j to its successor[s] to E.

a. Your task is to write detailed pseudo code (using English that is "close" to C++) procedures avoiding repeated states for:
   a. Performing a depth first search in the graph G_1 The goal is to check if the number k is on the graph. Evaluate the completeness and complexity of your procedure.
   b. Performing a breadth first search in the graph G_1 The goal is to check if the number k is on the graph. Evaluate the completeness and complexity of your procedure.

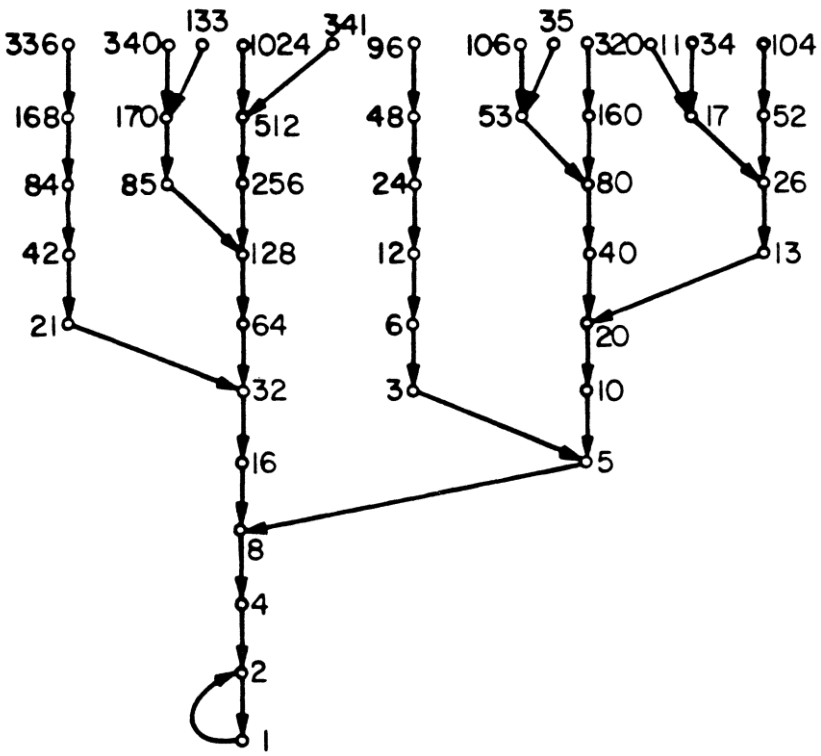

Figure 1, The Collatz Graph