CSCI B365 – Computer Graphics

Project04 (10pts + up to 8 bonus pts)

- This is an **individual work**. Please code independently and don't share any code at any time with others before grading. Violation of this code sharing policy results in a zero assignment or/and course grade.
- Discussions of designs are highly encouraged.
- **One of the more important things in programming is planning**, even for the simplest program. If the planning is thorough, the coding will be easy, at least for these programs. The only errors likely to be encountered are syntax errors. These are usually caused by typing errors, boundary condition problems (frequently off by one errors), or (we hope not) lack of knowledge of the language details.
- **ALL commentary and planning should be done PRIOR to beginning to write the program**. Once this is done, the program is almost written. The sooner coding begins, the longer the program will take to do correctly.
- **The programmer should always design for correctness and clarity first**, and worry about efficiency after it is determined by testing that the simple solution is deficient in speed or in some other way.

Question (10pts):

In this assignment, you augment the sample starting code ("Project04_startingCode.cpp") which is provided by the instructor and can be found in your BB. In particular, you will add two fingers to the robotic arm shown in the sample starting code.

Requirements
1. Review Lecture09 and its accompanying sample code before we start.
2. The two fingers should look something like (CAN be different) the two fingers displayed here (note, use **glutSolidCube** instead of glutWireCube):
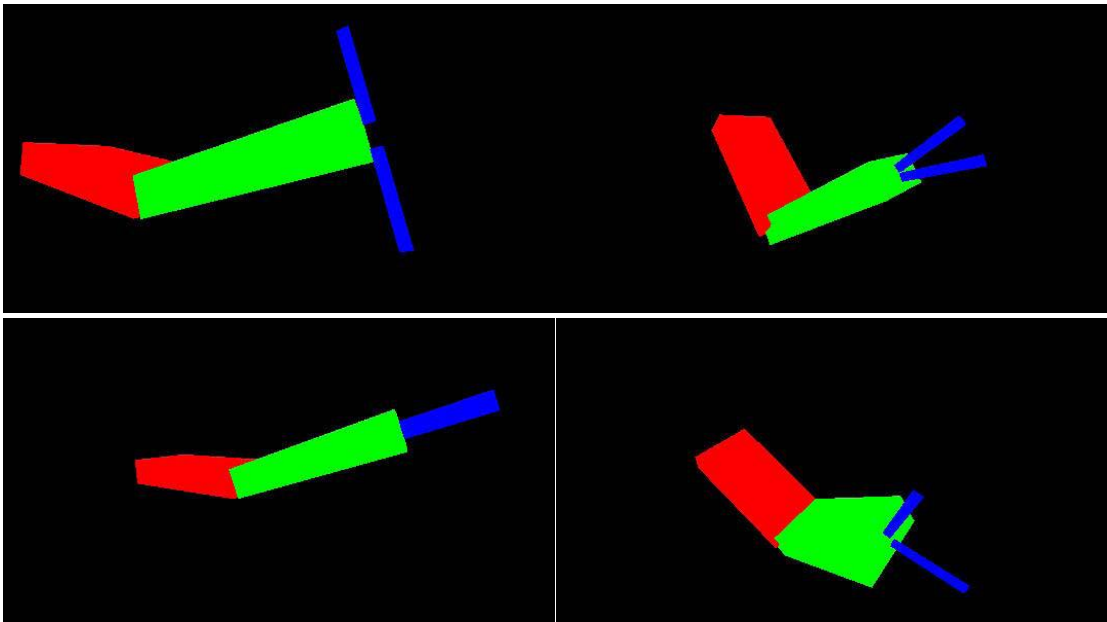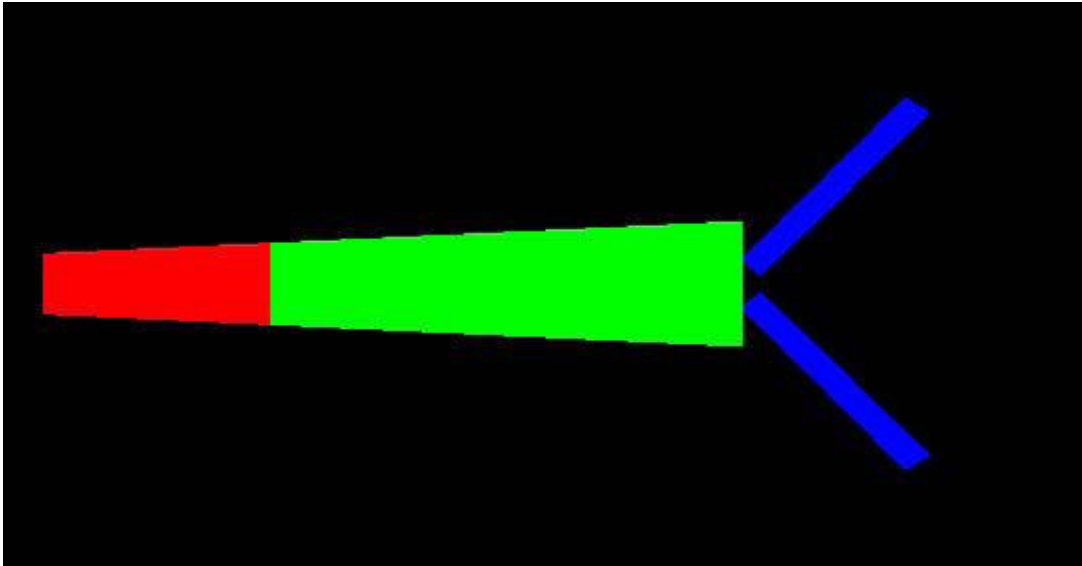
3. The two fingers should pivot at a point near where they join the lower arm, as if they were pinching something.
4. Add appropriate animation.
5. **Add the following controls** allowing the user's interaction:
   1) **Space Bar:**   Toggle Animation (on/off)
   2) **r/R:**   Reset the scene to its initial status.
   3) **s/S:**   Positive/negative shoulder rotation about Z axis.
   4) **e/E:**   Positive/negative elbow rotation about Z axis.
   5) **o/O:**   Open/Close the fingers
   6) **c/C:**   Close the fingers
   7) **x/X:**   Positive/negative X-axis shift of the robot.
   8) **y/Y:**   Positive/negative Y-axis shift of the robot.
   9) **z/Z:**   Positive/negative robot rotation about Z-axis.
   10) **UP/DOWN ARROWS:**   (zoom in/out) Z-axis shift of the robot.
   11) **LEFT/RIGHT ARROWS:**   Y-axis rotations of the robot.
   12) **PAGE UP/DOWN:**   X-axis rotations of the robot.
   13) **ESC:**   exit
6. Experiment with the elbow and finger angles to determine reasonable maximum and minimum joint angles. Implement hard coded maximum and minimum joint angles for these joints. For example, the arm should not pass through the shoulder.
7. **Instructions for user interactions** must be displayed in the standard output window.
8. Carefully design (a sample design "Project04_sample_design.pdf" is also provided) the solution first, then start the coding from scratch, and add the design to the program as comments (part of the documentation).
9. Both coding style and documentation contribute to the grading score.
   a. Try your best to add appropriate documentation in your code so even an outsider can understand your method.

b. The author's name, file name, purpose of the program, all user defined (except the main function) functions' input, output, and action/process must be included in the documentation.

c. Do not use global variable if possible.

d. Do not do hard coding if possible.

e. Do not make a single function too long. Implement each single and small task in functions.

12. Name the source code as "project04.cpp" and submit it to blackboard.

13. You do NOT have to use the provided starting code. If you use it you are free to modify the sample code and add any extra features.

14. A sample design is also provided.

Bonus1 (up to 20pts)

A robot that consists of at least the following components with the required features:

1) Head and Torso (1pts)

2) Left and right arms including the forearm and the upper arm, and at least 2 fingers in each hand (1pts)

3) Left and right legs including the upper leg and lower leg, and foot (1pts)

4) Add animations so the robot developed from above steps becomes a "walking/dancing" robot. The animation must be some animation about the robot. The robot body, arms, and legs should have some different movements. (up to 5 pts)

References:

- The sample starting code "Project04_startingCode.cpp" in your blackboard.
- Lecture slide "Lecture09".