Special Study Options/Independent Study Questionnaire

Student:
Please complete the following questions regarding the proposed SSO and submit it to your sponsor in electronic format. Please be cognizant of proper capitalization, punctuation, and grammar as the information will appear in the Forum catalog exactly as submitted.

Sponsors: *Please review the document and complete the* **Google form** *located in the faculty Blackbaud resource tiles to submit the proposal.*

1. Sponsoring Faculty Member: Michael D'Argenio

2. Department: Engineering and Computer Science

3. Initiating Student(s): Brendan Apple and Morgan Packard

4. Title of Proposed Study as it will appear on the transcript ("Forum" or "Independent Study" must be included in title.): "Rendering Graphics in the Terminal and the Dark Arts of C++ Forum"

5. Choose type:
   Forum: A group of students engaged in learning about the same subject under the guidance of an NCSSM faculty member. It involves a minimum commitment of 2 hours per week, at least 60 minutes of which is devoted to a weekly instructional meeting. All participating students are registered the same way, though some may play a leadership role in the study.

6. Academic Merit: Identify how this course enriches or complements your academic studies, or adds value to your understanding of the world scientifically, culturally, socially, historically or otherwise.

There are subjects in programming that many do not touch—too complex or strange to be worth teaching except within the purview of a computer science major. Image convolution, bitwise operators, pointers, and multithreading are often left ignored in favor of, admittedly, more immediately useful concepts. Yet, many of these ignored concepts are fundamental to how computers work and once understood, can help create much faster and simpler programs. This forum seeks to bring these "dark arts" to light through the lens of a memory buffered video player, which plays video compressed into ASCII and shown in the console. It will also focus on the C++ programming language, as it is a common compiled language, which allows for lower level memory manipulation. Through C++'s lower level nature, students will gain a fuller view of these concepts than with high level languages like Java or Python. Students are NOT expected to have prior knowledge of C++, but are expected to have learned basic programming in some language.

7. Constraints: Identify any resources needed and how you will supply these resources.
   All students are required to have a laptop.

8. Specify Meeting Times- Note that a minimum of 2 hours per week is required (at least 1 hour in class, the other can be in class or independent). Indicate the day(s) and time(s) the study will meet and whether meeting

format will be in-person or by ZOOM. (Please note that meetings must be entirely in-person, including the sponsor, or entirely virtual. There is not a hybrid option.) SPECIFIC DAY/TIME/FORMAT IS REQUIRED
>   Wednesday 4:05 - 5:05 pm

9. Specify Commitment: What is the average amount of time, outside of formal meetings times, that a student is expected to commit to this study?
>   Meetings: 1 hr/week
>   Outside of Meeting Times: 1 hr/week

10. Meeting Location: Indicate building and room number where the study will meet for at least the first two instructional meetings of the study. NOTE: Sponsoring faculty member is responsible for making any necessary room/space reservations.
>   E-Lab, ETC

11. Types of Assignments: Please include a week-by-week syllabus of the course.

Central Project: Memory Buffer-Based Video Player

Week 1: C++ Compiler and Compiled Languages
- Instruction: Compiled Languages
- Assignment: Download C++ Compiler

Week 2: Basics of C++
- Instruction: Types (Signed and Unsigned), Conditionals, Loops, Input, and Output
- Assignment: Loop through provided list and output the sum of all even numbers

Week 3: Print Images with ANSI Character Codes and Unicode in Console
- Instruction: ANSI Codes and Unicode
- Assignment: Print ASCII art in console that changes color and clears.

Week 4: Create A Video Buffer
- Instruction: Memory Addresses and how to use Pointers and References
- Assignment: Implement a constant time access video buffer with pointers and malloc() that stores character data

Week 5: Add Color Data
- Instruction: Bitwise operators to compress color into one byte and read back into ANSI codes.
- Assignment: Add color data to the video buffer and print an ASCII animation with color.

Week 6: Buffer Renderer Class
- Instruction: Classes in C++.
- Assignment: Create a class to abstract the printing of the video buffer in console
- (Optional): Create a separate class to abstract the video buffer

Week 7: Color Enums and Pixel Structs
- Instruction: C++ Structs and Enums.
- Assignment: Create a pixel struct that holds color information (based on color enum), and coordinates on "screen"

Week 8: Read Animations from Files
- Instruction: File Reading and File Formats
- Assignment: Create a personal file format to store the pixel data of your animation, which you read from and write to

Week 9: Multithread the Renderer
- Instruction: Multithreading
- Assignment: Place the reader for your video buffer on a separate thread, allowing the animation to move independently of "render time"

Week 10: Errors, Exit Codes, and Command Line Arguments
- Instruction: Throwing and Catching Errors, Creating Useful Exit Codes, and Command Line Arguments
- Assignment: Give your program useful exit codes, and read from the file specified in a command line argument, throwing an error if the file is not found

Week 11: Keyboard Interrupts
- Instruction: Using Libraries with C++ and Keyboard Interrupts
- Assignment: Create keyboard interrupts to change playback speed, and/or pause the animation

Week 12: Playing External Videos
- Instruction: Image Convolution
- Assignment: If passed specific command line arguments, have your program compress a mp4 video file into your custom file format with image convolution

Week 13: Project Work Time / Troubleshooting Time
- If people are interested talk a little about UI elements

Week 14: Project Work Time / Troubleshooting Time
- If people are interested talk a little about UI elements or any other topic

Week 15: Presentation Day
- Everyone shows off their console video renderers, including the cool stuff they've done and are doing beyond the forum's instructional scope.