

1) The frame rate reported by the program when the window is different sizes, specifically 1x1, 300x300 and full screen. Explain your results.

**ANSWER:**

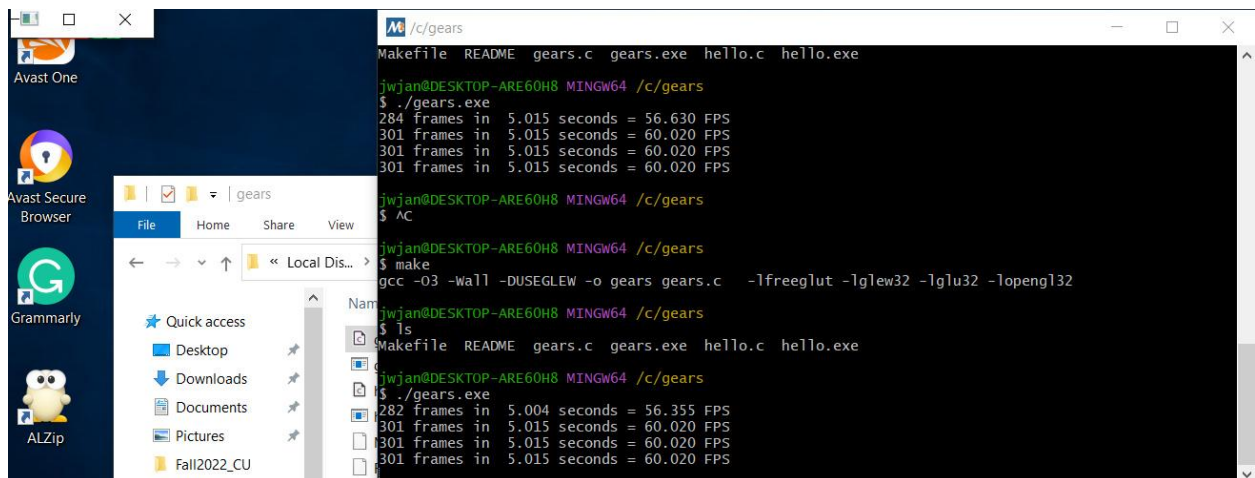
**1x1:**

282 frames in 5.004 seconds = 56.355 FPS

301 frames in 5.015 seconds = 60.020 FPS

301 frames in 5.015 seconds = 60.020 FPS

301 frames in 5.015 seconds = 60.020 FPS



```
Makefile README gears.c gears.exe hello.c hello.exe
jwjan@DESKTOP-ARE60H8 MINGW64 /c/gears
$ ./gears.exe
284 frames in 5.015 seconds = 56.630 FPS
301 frames in 5.015 seconds = 60.020 FPS
301 frames in 5.015 seconds = 60.020 FPS
301 frames in 5.015 seconds = 60.020 FPS
jwjan@DESKTOP-ARE60H8 MINGW64 /c/gears
$ AC
jwjan@DESKTOP-ARE60H8 MINGW64 /c/gears
$ make
gcc -O3 -Wall -DUSEGLEW -o gears gears.c -lfreeglut -lglew32 -lglu32 -lopengl32
jwjan@DESKTOP-ARE60H8 MINGW64 /c/gears
$ ls
Makefile README gears.c gears.exe hello.c hello.exe
jwjan@DESKTOP-ARE60H8 MINGW64 /c/gears
$ ./gears.exe
282 frames in 5.004 seconds = 56.355 FPS
301 frames in 5.015 seconds = 60.020 FPS
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```

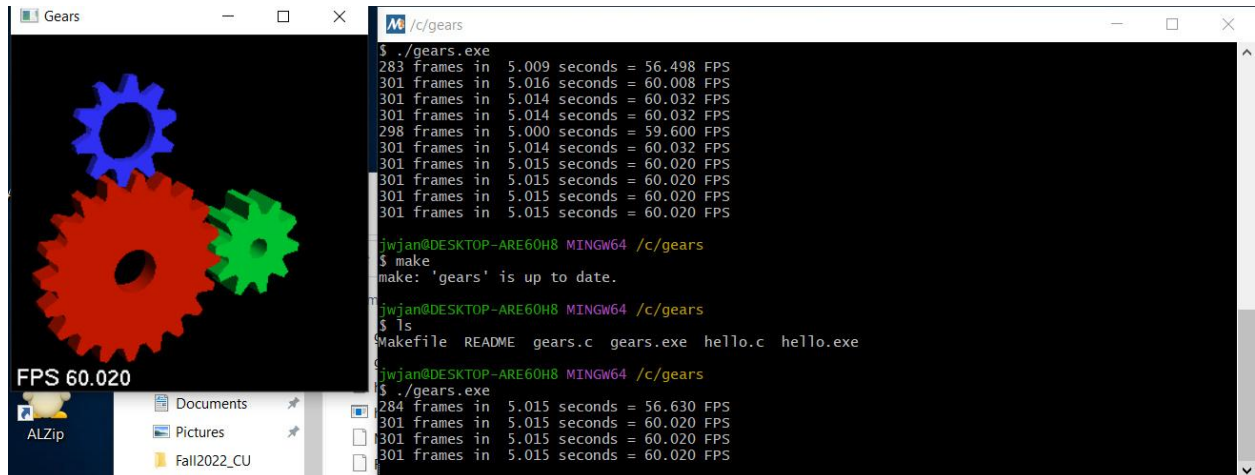
**300x300:**

284 frames in 5.015 seconds = 56.630 FPS

301 frames in 5.015 seconds = 60.020 FPS

301 frames in 5.015 seconds = 60.020 FPS

301 frames in 5.015 seconds = 60.020 FPS



## FullScreen:

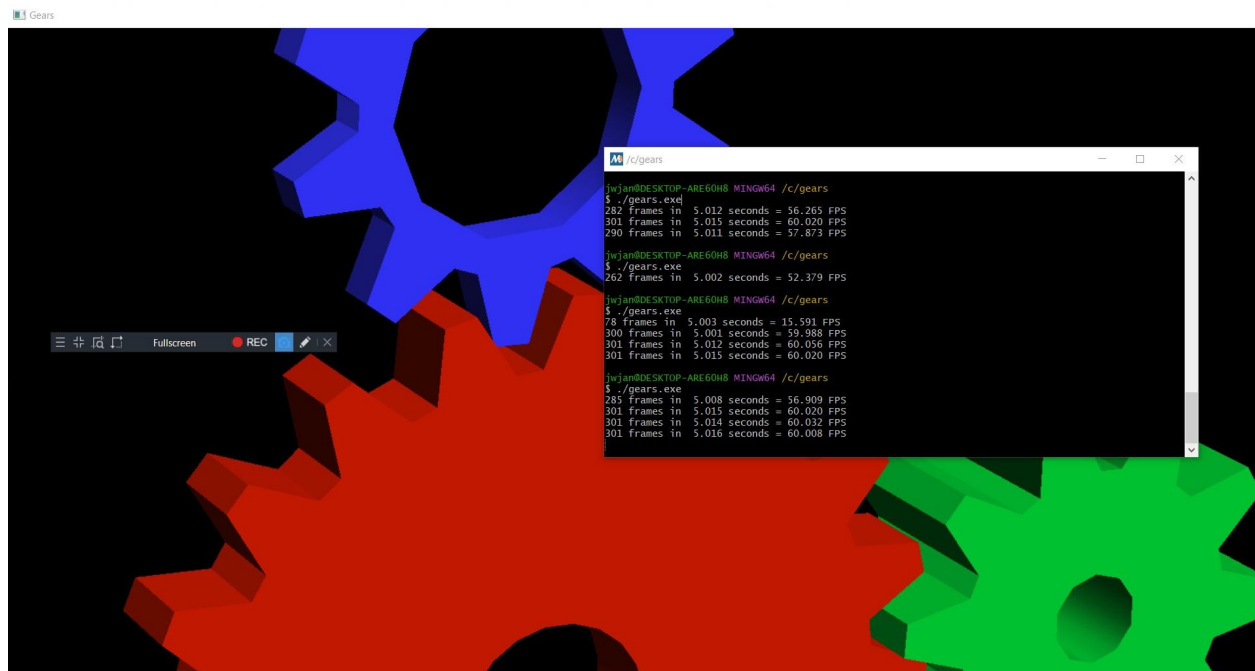
285 frames in 5.008 seconds = 56.909 FPS

301 frames in 5.015 seconds = 60.020 FPS

301 frames in 5.014 seconds = 60.032 FPS

301 frames in 5.016 seconds = 60.008 FPS

292 frames in 5.059 seconds = 57.719 FPS



2) On some systems the frame rate is a small round number like 60 or 72 or 85 frames per second, and sometimes it is a large number, thousands or tens of thousands of frames per second. Explain why this occurs.

**ANSWER:**

The FPS can be different depending on the processing power of the graphic cards and the refresh rate of the monitor, etc., so the frame rate will always change. However, the frame rate is not just only depending on the hardwares. If the system has too low FPS, there can be issues. One of the examples is that there might be some processes that use a lot of CPU or RAM. Easy way to fix the low FPS in this case is closing background processes by going to the Task Manager->CPU and Memory tabs, and closing unnecessary processes that are using a lot of CPU. Another way to fix this is to update the graphic drivers. Graphic drivers take an important role in frame rates and if the graphic driver is old enough, it cannot handle newly released softwares or games because they may require certain levels of ability of the graphic driver. New features added GPU drivers can really boost the FPS. There is another case where the computer's frame rate suddenly drops a lot, especially while playing PC games. In this case, there can be an issue with the servers or connection. Also, based on my research, there are rare cases where there is something wrong with graphic time parts in the code of the software or game. Thus, frame rate matters a lot and usually, having a higher frame rate, especially in high graphics games, will provide a smooth movement of the screen and animations, since the more image can appear on the screen every second that makes the animation smoother.

3) Time required to complete the assignment.

**ANSWER:**

It took me two days to figure out setting up the OpenGL environment, since this was my first time getting into Computer Graphics. I ended up having a meeting with a professor, which really helped me a lot, since there were some errors in my openGL environment. Professor kindly helped me through the zoom meeting and the reason was I missed a small step while setting up the openGL. I learned that every little characters and the steps are very important in this environment. To complete this assignment, it took me around an hour to complete because I needed to research more about computer graphics and the writing took little time for me.