EEN118 LAB FIVE

The purpose of this lab is to give you more practice with nice clean structured designs. Make absolutely sure your programs are very clear and obviously correct even to a reader who doesn't know what your design plan was. Grading will be on this basis.

The first two parts should be very fast. Remember the % operator. If you find that parts 1 or 2 are taking more than just a few minutes to work out, ask the Lab Guy for a hint. You have probably just not realised what an easy thing to do it really is.

1. *What Time Is It?*

The library contains functions called `get_clock_time` and `get_calendar_date`. They both take no parameters and return an integer as their results. The first tells you the time of day, hours, minutes, and seconds, squeezed into six digits: at exactly 5:30 p.m. the value would be 173000. The second tells you the date, year, month, and day, squeezed into eight digits: on the 25th of September 2018 the value would be 20180925.

Write a simple program that obtains the current year, month, day, hour, and minute as separate integers. After a little calculation, your program should contain these five lines or something very much like them:

```
print("year: ");  print(year);   newline();
print("month: ");  print(month);  newline();
print("day: ");  print(day);    newline();
print("hour: ");  print(hour);   newline();
print("minute: ");  print(minute); newline();
```

when run, it should produce output looking something like this:

```
year: 2018
month: 9
day: 25
hour: 17
minute: 30
```

but with the correct numbers of course.

Consider for a moment what very rare problem could possibly occur if you start to run your program just a tiny fraction of a second before midnight. What could your program do guard against that problem?

2. *The Monroe Doctrine.*

Who uses the continental clock? Everyone knows hours are supposed to range from 1 to 12, not zero to 23. Modify your program so that the hour is reduced to the proper 1 to 12 range, but make it also note whether the time is "`a.m.`" or "`p.m.`".

And while you're at it, make it look official and scientific, with everything aligned to the right, like this:

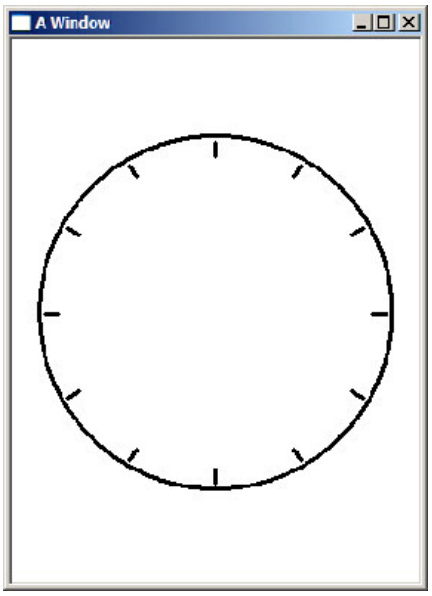
```
  year: 2018
 month:    9
   day:   25
  hour:    5 p.m.
minute:   30
```

(The Monroe doctrine was the early 19th Century U.S. policy, introduced by President James Monroe, intending to remove the European influence from North America. I'm sure you already knew that.)

3. *A Clock Face.*

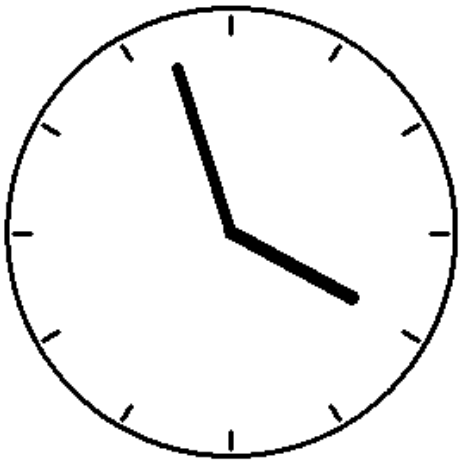
Create a window slightly taller than it is wide, and draw a large circle exactly centred within it. Make twelve marks regularly spaced around it near the edge, so that it can act as a clock face.

You don't need to duplicate this sample, it is just there to make the plan clear.



4. *A Whole Clock*

Making use of your programming for parts 1 and 2, draw hands on your clock at the correct positions for the current time of day. A little trial-and-error experimentation may be needed to get things just right.



A hint towards correctness:

The time is 3:57, so the hour is 3, but where should the hour hand be pointing?

5. *Add a Second Hand and Animate Your Clock.*

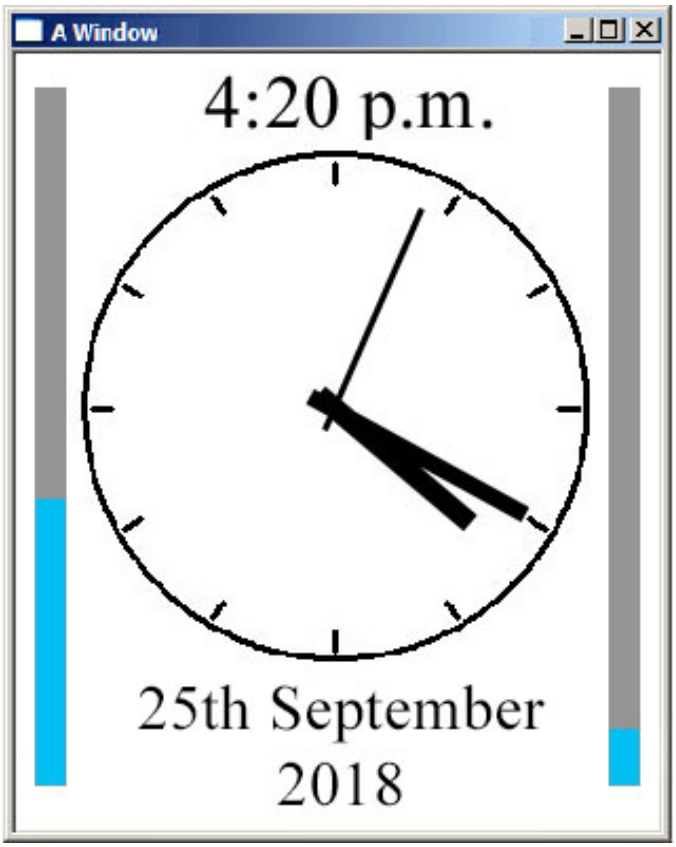
Make your clock actually run, so that it keeps updating itself to show the correct time continuously for as long as you let the program run. You really need a second hand, with just hour and minute hands it gets really boring watching for long enough to know that it moves correctly.

6. *A Complete Product.*

This is why the window isn't square.

Use the space above and below the clock to display the time and date in a nice human-friendly way, like you see below.

For a really modern look, we want a couple of progress bars, like in the picture below (of course, you can use a nicer colour and generally make it look better). The left bar in this picture shows progress through the hour (4:20 is a third of the way through the hour from 4 to 5). The second shows progress through the minute (4 seconds out of 60). You can show progress through different periods if you prefer.



You have already seen the `write_string` function, but you may not have noticed that it doesn't only display strings, it will happily render `int`s and `double`s: whatever you throw at it. The date was produced by four separate calls to write_string: one for the 25, one for the "th", one for the "September", and one for the 2018.

What are you going to do to ensure that 1405 is displayed as 2:05, and not 2:5?