

# CPS122 - OBJECT-ORIENTED SOFTWARE DEVELOPMENT

## Individual Programming Project 2

**Reading Quiz:** Monday, February 15, at the start of class

**Preliminary Milestone Due:** Monday, February 22, at the start of class

**Complete Project Due:** Tuesday, March 2, at the end of lab

**Purpose:** To give you experience developing a complete system that uses multiple classes

### Introduction

It is a common sight in locations like hotel lobbies around the world to see several clocks displayed showing the time in different places - like in this picture taken in the lobby of a hotel in Lanzhou, China showing time in Moscow, New York, Australia and other places:



For this project, you will be using the clock classes you developed in Lab 5 to produce a similar display. Unless you request otherwise, your project will be posted on the department web server, so that you can show off your work to friends and family during spring break. (You will also want to look at similar projects from previous years to get ideas - though you should bear in mind that the project requirements in some of the previous years were significantly different!)

### Requirements

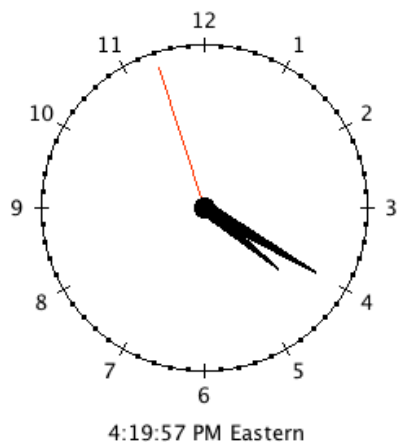
1. Create a display of multiple clocks showing the current time in different locations. The number and placement of the clocks is up to you (use your creativity, and look at what others have done for ideas). As a minimum, the following must be true.
  - The display must include 4 or more clocks, each displaying the current time in a different time zone.
  - Each clock must be labelled appropriately (e.g the name of its time zone or the name of a prominent city in that time zone). (The label can be below the clock or at some other position.)

- The clocks must be of two or more different sizes. The largest clock must be at least twice as big as the smallest. (Of course, all the features of the clocks must be scaled appropriately to their size.) You will probably want the larger clock to display the local time zone (Eastern), though you could use it to display some other zone if you prefer (e.g. the zone of your home town.)

2. Make the overall appearance of the clocks aesthetically pleasing, by incorporating some or all of the following improvements.

- “hash-marks” around the face of the clock:
  - simplest - at 12, 3, 6, and 9
  - better: at every hour
  - best: more prominent marks at the hour locations, with 4 smaller marks at the minute locations in between
- numbers correctly positioned around the face of the clock:
  - simplest - at 12, 3, 6, and 9
  - better: at every hour(Note: correct positioning that scales with clock size is important!)
- hour and minute hands that are not simply straight lines - the second hand can continue to be a line.
  - simplest: balls at clock center and ends of the hands
  - better: draw the hand as a polygon or use arcs to produce a curved effect
- time displayed in both digital and analog form, including "AM" or "PM" - perhaps by adding the digital time to the label for the clock
- make good use of color to improve the overall appearance of the page the individual clock faces.
- lots of other possibilities - see previous projects by other students for ideas

The following illustrates what several (but by no means all!) of these improvements might look like - but don't feel you have to make things look just like this!



## Reading Quiz and Milestone

Waiting until the last minute to start this project is definitely a very bad idea! For this reason, there will be a reading quiz and a preliminary milestones due as noted above to help you get working on the project early.

1. Reading quiz: **based on the implementation notes below**.
2. Milestone - submit a version of the project that displays at least four labelled clocks correctly displaying the time in different time zones. (Aesthetic appeal is not important at this point)

## Evaluation

Credit will be based on the following:

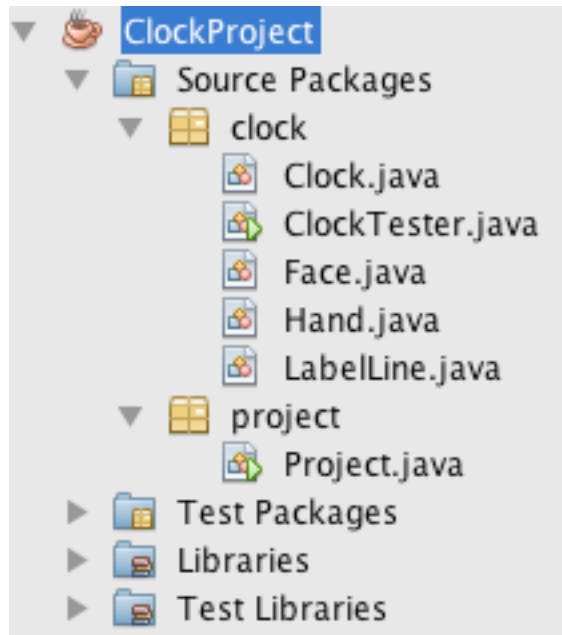
1. Correct operation and neat, aesthetically pleasing appearance. (maximum 75 points)
2. Use of good methodology, as taught in class, including use of comments, choice of names, appropriate use of local variables, good use of white space to aid readability, and clear overall approach. It is particularly important to make good use of symbolic constants. (Maximum of 10 points)
3. A reading quiz **based on the implementation notes below** (6 points)
4. Completing the preliminary milestone by the milestone due date. (Penalty of 10 points if not done on time; lesser penalty if partially done. Credit for the actual code will be included in the final grade for the project.)
5. Following the submission directions below **exactly**. (5 points)

There is no provision for extra credit on this project.

A blank project cover sheet is attached and should be stapled to the front of the final submission of your project.

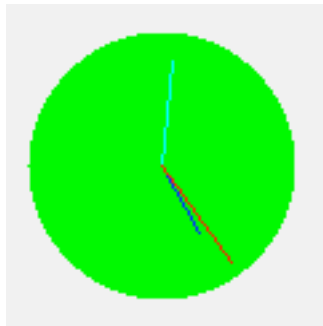
## Implementation Notes:

1. To start the project:
  - a. Copy the `ClockProject` folder from the common volume to your server volume. This folder contains a NetBeans project with a “starter” version of the main class (`Project`).
  - b. Copy the `src/clock` folder from the `Clock` folder you used for lab 5 to the `src` folder of the project folder. (You can copy a folder from one place to another on a Macintosh by holding down the option key while dragging the folder to its destination.) When you have done this correctly, the project window will look like this when you open the project in NetBeans and click the disclosure triangles.



- c. At this point, it should be possible to run the project. You should see a clock like the one you created in lab, correctly displaying the time in the Eastern time zone.
2. The main class (Project) contains code that will allow your project to run either in NetBeans or as an applet on the web. You will need to add code to this class to create your clocks
  - a. All the code you add to the Project class will go in one of two places:
    - At the point indicated in the start() method.
    - Symbolic constant declarations at the end of the class
  - b. In addition, you may need to change the declarations of the symbolic constants APPLICATION\_HEIGHT and APPLICATION\_WIDTH if you need more screen space to work with.  
**If you do this, be sure to change the boundaries specified in Project.html as well!**
  - c. You may also want to change the value of the constant BACKGROUND\_COLOR to better fit the way you have set up your clocks. Feel free to do this.
  - d. **Be sure to delete the comments and examples you are told to delete! Leaving any of these in the project you turn in will result in a point reduction!**
  - e. Do not change anything else in the Project class.
  - f. Of course, you may also need to make changes to the classes representing the clock and its face, hands, and label line - but see 8b below before changing the Clock class.
3. When creating a clock, its time zone is specified by giving an offset relative to Greenwich Mean time (GMT). This will be a string having the form GMT+hh:mm or GMT-hh:mm. For example, Eastern Standard Time is GMT-05:00, meaning that Eastern time is 5 hours earlier than Greenwich Mean Time. (In most cases, the minutes part of the specifier is not needed and can be omitted, but some time zones such as Newfoundland need it.)

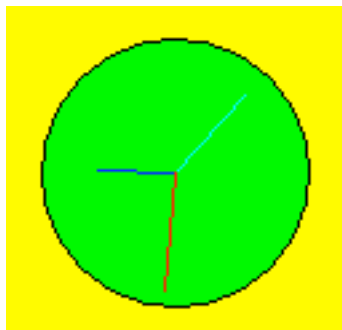
4. The coordinate system used for the Java graphic system is like that used in CPS121 - i.e. the x-axis is horizontal and the y-axis is vertical, and (0,0) is the top left corner of the screen, with x increasing going right and y increasing going down.
5. The `java.awt.Graphics` class has a number of methods that you will need when drawing improved versions of the parts of your clock.
  - a. For most shapes, there is a method whose name is of the form `draw_____` draw and a method whose name is of the form `fill_____`. The “draw” method draws the outline of the shape, while the “fill” method draws a filled in shape. For example, suppose you used `fillOval()` instead of `drawOval()` in the Face class. Then your clock would look like this:



- b. You can use both of these methods together to draw both a frame and an outline (using different colors for each, of course.) For example, if you used code like this in your Face class:

```
graphics.setColor(color);
graphics.fillOval(leftX, upperY, faceDiameter, faceDiameter);
graphics.setColor(Color.BLACK);
graphics.drawOval(leftX, upperY, faceDiameter, faceDiameter);
```

Your clock would look like this:



- c. It is also possible to draw other shapes on top of each other - e.g. a ring can be drawn by drawing a larger circle and then a smaller circle.
  - d. **Important:** if you draw two things at the same place, the one you draw last will be on top. Since drawing is opaque, that means it will hide anything underneath it. So, in the

example above, if you drew the filled oval after you drew the outline, the filled oval would be the only thing you would see!

6. To improve the appearance of the hour and minute hands, you will probably want to create a new `FancyHand` class, which you use for the hour and minute hands, while continuing to use the `Hand` class you developed in lab for the second hand. Of course, you will also need to change the constructor of the `Clock` class to use your new class for the hour and minute hands.
7. There are several things you need to keep in mind to produce aesthetically pleasing results:
  - a. If you display 12 hour markers around the face of the clock, the centers of the numerals should be located at 30 degree intervals around an invisible circle perhaps 10%-15% larger than the face circle itself. The `drawString()` method of the `Graphics` class requires you to specify the coordinate of the lower left corner of the string - which will require subtracting off half the width of the string from the calculated x coordinate of the center and adding half the height of the string to the calculated y coordinate of the center. See the `draw()` method of class `LabelLine` for how to get the width and height of a displayed string.
  - b. When showing digital time, recall that the convention is to use two digits for minutes and seconds even if only one is necessary - e.g. at time like 1:05:02 PM is represented this way, rather than 1:5:2.
  - c. Also, recall that in digital time, while the internal representation of the hour ranges from 0 .. 23, the hours displayed go 12, 1, 2, 3 ... AM, 12, 1, 2, 3 ... PM.
8. The `clock` package that you copy from the lab will also contain the `ClockTester` class. You can use this to test correct operation of your clocks, since the project only displays the current time and you may want to be able to test displaying specific times. (And, in any case, I will want to do this when testing your final submission!)
  - a. You can use this class for testing your clock by making it the main class for your project. Here's how:
    - Control-click on the Project itself, and choose `Properties` at the bottom of the pop-up menu.
    - Select the `Run` panel in the window that is displayed.
    - Click the `Browse` button next to the `Main` class field
    - Choose `clock.ClockTester`
    - To return to running your project as the main class, follow the same process but choose `project.Project`.
  - b. Therefore, be sure to not change the parameters of the `Clock` class constructor or its `setTime()`, `setCurrentTime()` and `start()` methods, since the tester makes use of these. (The `ClockTester` class must still compile correctly).
9. Your project is configured to let you run your program as an application, but you should also test it when run as an applet by opening the file `Project.html` in a web browser. (You can drag this file to the appropriate icon to launch that browser.) On MacIntosh's Safari has problems with applets located on disk, and Chrome seem to have a problem with flicker when drawing this applet so you may get the best results with Firefox.

## **Final Submission Directions - Please follow exactly!**

Recall that the project is due at the end of the lab period. The lab instructor will **NOT** stay later than the end of the lab period. The project will be considered late if it is not finished by this time. (Of course, you can always turn the project in earlier). A printed version must either be turned in at this time, or slid under the door of my office, and the project must be on the server by this time,

1. If your project requires a screen area bigger than the default value of 800 x 600, change the values specified in **both** Project.html and Project.java. (The values in the .html file will be used when running your program as an applet.)
2. Be sure comments you were instructed to delete are deleted - and that you have included appropriate comments of your own.
3. Be sure your variables and constants have appropriate names - e.g. DEMO\_LEFT\_X is not an appropriate name for a constant in your final program!
4. After making all the changes to your code you intend to make, use the "Clean and Build Project" option in NetBeans (in the Run menu or using the toolbar icon) to produce a clean executable of your project (the file ClockProject.jar in the dist folder in your project.) If you make any changes to your code after doing this, you must repeat this step. The version of your program that will be tested (and that will determine your grade) will be this executable.
5. Test your completed program by running Project.html in a browser (drag it to a browser.) This is what someone will see if accessing your project over the web.
6. Put a copy of the complete project folder in the drop box on the server. Be sure to do this even if you are developing the project on your own computer.
7. What you turn in must include the following, neatly stapled together
  - The coversheet below
  - Printout of the java sources for the classes you wrote or modified. You just need to turn in a single program, reflecting your finished product. However, you will probably find it wise to develop your improvements incrementally, and to save a copy of working code before moving on to the next feature in the case of catastrophic error. Be sure you have included a suitable prologue comment in each class, and have deleted unnecessary lines in Project.java.
8. The professor will post completed projects on the department web site during the break. However, if for some reason you prefer not to have your project posted, please let the professor know by email.

**Unless you specifically request otherwise, a copy of your finished project will be posted on the department server for others to enjoy!**

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# CPS122 - OBJECT-ORIENTED SOFTWARE DEVELOPMENT - INDIVIDUAL PROJECT 2

Author \_\_\_\_\_

## Operation: Basic Requirements Met (max 50 points) \_\_\_\_\_

- |   |                              |                                    |                             |
|---|------------------------------|------------------------------------|-----------------------------|
| 4 or more clocks                                      | <input type="checkbox"/> Yes | <input type="checkbox"/> Partially | <input type="checkbox"/> No |
| Different time zones, labeled appropriately           | <input type="checkbox"/> Yes | <input type="checkbox"/> Partially | <input type="checkbox"/> No |
| Correct analog times displayed                        | <input type="checkbox"/> Yes | <input type="checkbox"/> Partially | <input type="checkbox"/> No |
| Different sizes - largest at least two times smallest | <input type="checkbox"/> Yes | <input type="checkbox"/> Partially | <input type="checkbox"/> No |
| Overall scales correctly                              | <input type="checkbox"/> Yes | <input type="checkbox"/> Partially | <input type="checkbox"/> No |

## "Hash marks" (max 7 points) \_\_\_\_\_

- |  |                                      |   |   |   |
|--|--------------------------------------|---|---|---|
| <input type="checkbox"/> Not attempted | <input type="checkbox"/> 3, 6, 9, 12 | <input type="checkbox"/> Every hour/min not different | <input type="checkbox"/> Min&hours differentiated | <input type="checkbox"/> Positioned/scaled properly |
|--|--------------------------------------|---|---|---|

## Numbers (max 5 points) \_\_\_\_\_

- |  |                                      |                                     |   |
|--|--------------------------------------|-------------------------------------|---|
| <input type="checkbox"/> Not attempted | <input type="checkbox"/> 3, 6, 9, 12 | <input type="checkbox"/> Every hour | <input type="checkbox"/> Positioned/scaled properly |
|--|--------------------------------------|-------------------------------------|---|

## Hands (max 7 points) \_\_\_\_\_

- |  |  |                                   |  |   |
|--|--|-----------------------------------|--|---|
| <input type="checkbox"/> Not attempted | <input type="checkbox"/> Balls or other simple | <input type="checkbox"/> Polygons | <input type="checkbox"/> Arcs or other challenging | <input type="checkbox"/> Positioned/scaled properly |
|--|--|-----------------------------------|--|---|

## Digital Time (max 5 points) \_\_\_\_\_

- |   |  |                                  |  |
|---|--|----------------------------------|--|
| <input type="checkbox"/> Not attempted  | <input type="checkbox"/> Partially correct | <input type="checkbox"/> Correct | <input type="checkbox"/> Positioned properly |
| Minutes, seconds < 10 handled correctly | <input type="checkbox"/> Yes               |                                  | <input type="checkbox"/> No                  |
| Midnight, noon handled correctly        | <input type="checkbox"/> Yes               |                                  | <input type="checkbox"/> No                  |

## Use of Color and other Aesthetic Considerations (max 5 points) \_\_\_\_\_

- |                               |  |                                     |                                |
|-------------------------------|--|-------------------------------------|--------------------------------|
| <input type="checkbox"/> None | <input type="checkbox"/> Colors garish | <input type="checkbox"/> Nice color | <input type="checkbox"/> Other |
|-------------------------------|--|-------------------------------------|--------------------------------|

## Operation Total (Max 79) \_\_\_\_\_

### Methodology Expectations:

- All methods have appropriate prologue comments and parameter tags that make the purpose of each parameter clear.
- Variable names clearly describe the item they name and follow OO naming conventions.
- Local variables are used where needed.
- Symbolic constants are used where needed
- Whitespace (indentation and blank lines) follows a consistent convention and makes the overall structure of the program clear by enhancing its readability.
- Overall structure of code is clear.

## Methodology Expectations Met (Max 10) \_\_\_\_\_

## Reading Quiz (Max 6) \_\_\_\_\_

## Submission Directions Followed Exactly (0 or 5 points) \_\_\_\_\_

## OVERALL TOTAL (Max 100) \_\_\_\_\_