CS 3330: Lab Assignment 11

Directions:

Complete the lab assignment described below.
Files to be created:

`DensityA.java`

Submission:

```
cs_submit CS3330_LAB-<section_letter> LAB11 <yourpawprint>.cs3330.lab11.zip
```

Description:

There are many factors that pilots must take into consideration when preparing for a flight. Ignoring some of them can have fatal consequences. One important calculation a pilot must perform determines the “density altitude”.

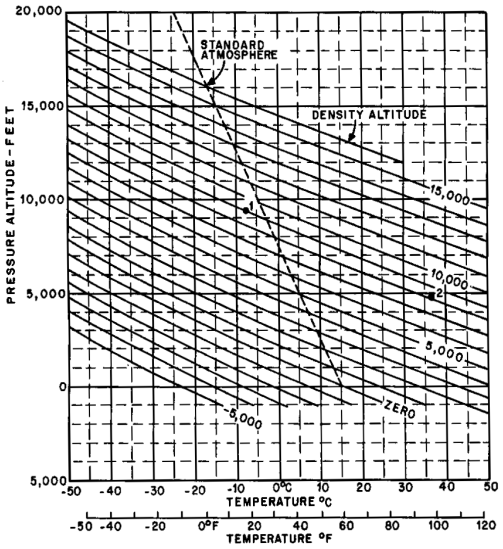
Basically, cold air is heavy or “dense” and the airplane propeller grabs the air easily. Hot, humid air is light or “gassy” and the airplane can struggle to perform as it doesn’t grab as much air each time the propeller turns. On a hot, humid day if you take off from an airport that is at 5000 feet in altitude, the heat and humidity could make the plane take off as if you were at 10,000 feet! A huge impact! If you don’t calculate this properly and you load the plane up with weight (passengers, luggage, etc.) you could crash on take-off. Air density is perhaps the single most important factor affecting aircraft performance. It has a direct bearing on:

- The lift generated by the wings — reduction in air density reduces the wing's lift.
- The efficiency of the propeller or rotor — which for a propeller (effectively an airfoil or wing) behaves similarly to lift on wings.
- The power output of the engine — power output depends on oxygen intake, so the engine output is reduced as the equivalent "dry air" density decreases and produces even less power as moisture displaces oxygen in more humid conditions.

The following effects result from a density altitude which is higher than the actual physical altitude:

- The aircraft will accelerate slower on takeoff as a result of reduced power production.
- The aircraft will need to achieve a higher true airspeed to attain the same lift - this implies both a longer takeoff roll and a higher true airspeed which must be maintained when airborne to avoid stalling.
- The aircraft will climb slower as the result of reduced power production and lift.

So now that you know a lot about the effects of “density altitude” on a planes performance, let’s look at a chart of how it is calculated manually.



DENSITY ALTITUDE CALCULATION

Your lab assignment is to successfully write a Java program with an algorithm to calculate density for the pilot and save them the time. If you're totally confused don't be -- it's actually easier than it sounds. You will need 3 inputs from the user:

1) alt = elevation of the airport you want to calculate this for
2) oat = the current outside air temperature (OAT) at that airport in Celcius
3) aps = the current air pressure setting at the airport (hygrometer)

The formula to calculate "density altitude" is:

Density Altitude = ((oat - (15 - (alt *0.002))) * 120)+(((29.92 - aps) * 1000) + alt)

TAKE-OFF DISTANCE CALCULATION

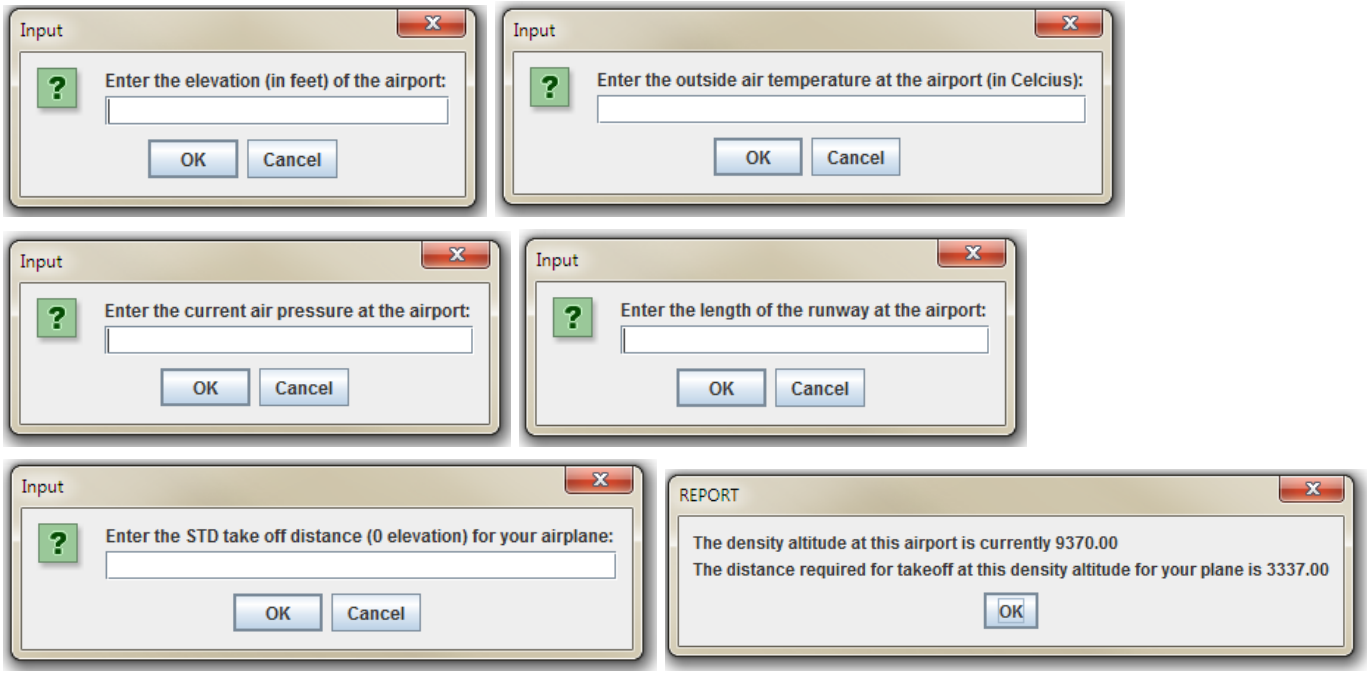
Every plane has a different "takeoff distance" requirement. Some smaller planes only require a distance of 1000 feet to take off while other, larger aircraft may need 7000 feet. Density altitude affects this distance. Assume that for every 100 feet of altitude increase your plane requires an additional 10 feet of takeoff distance. So if my plane normally requires 2400 feet to take off at an elevation of ZERO feet then it will need 3337 feet to take off if the density altitude is 9370 feet.

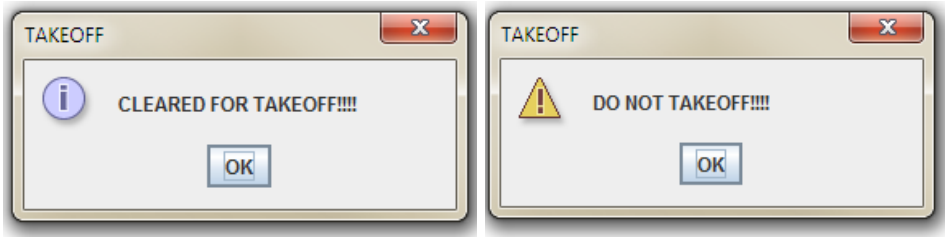
DensityA.java

Create the lab above using JOptionPanes for all the inputs and the dialogs at the end. There should be one showInputDialog for each of the input lines and two showMessageDialogs for the report. All of the dialogs can be within the main method of the class and DOES NOT need to instantiate DensityA objects.

The first of the two dialogs must give the density altitude and the distance required for takeoff using a plain message type.

The second of the two dialogs must give you either an information message that says CLEARED FOR TAKEOFF!!!!! and TAKEOFF in the box title if the Runway is long enough for the plane to takeoff. Otherwise it should use the warning message type and display DO NOT TAKEOFF!!!! and TAKEOFF in the box title. Example is below **(Each pop up happens one after the other, not all at once FYI).**





Inputs and Outputs (USE GUI NOT COMMAND LINE):

```
Enter the elevation (in feet) of the airport: 5000
Enter the outside air temperature at the airport (in Celsius): 35
Enter the current air pressure at the airport: 29.15
Enter the length of the runway at the airport: 5500
Enter the STD take off distance (0 elevation) for your airplane: 2400

The density altitude at this airport is currently 9370.00 feet. The distance required for
takeoff at this density altitude for your plane is 3337.00 feet. That is a safe condition.
```

Grading:

General: If your program does not compile, has run-time errors, or doesn't produce any I/O, your lab will have a grade of zero.

If you do not have Header Comments (including lab submission code) in EVERY file you create, this will also result in a grade of ZERO.

Rubric is as follows

5 points (no partial) - You must have good comments.
10 points – Using the correct JOptionPanes for each display and input.
10 points – Your output matches the sample output 1 to 1
5 points – Correct math calculation

BONUS:

Implementing Error Handling for input, so no negatives allowed for each input the user enters. To display errors use JOptionPane.ERROR_MESSAGE inside of showMessageDialog if a error has occurred.