INTRODUCTION TO PROGRAMMING
FINAL EXAM - PART I - TAKE HOME
50 POINTS

INSTRUCTIONS

For this part of the exam, please use this trix. Here are a few guidelines:
1. If you get stuck on one part, don't give up on the rest - just add comments for how you would get to the next step (so I can see that you understand the concepts) and then continue coding.
2. If you're having access issues first try using this doc to resolve it, then contact me right away if you are still unable to log in to access the trix.
3. Feel free to work with others in the class, but DO NOT:
   a. Copy another person's solution
   b. Seek help outside the class (e.g. your SWE friend)
4. You will be graded on **style** as well as functionality (you can lose up to 1 full letter grade for poorly formatted code) so make sure your solution adheres to all the rules in the style guide.
5. Please start early and reach out to me for help if you need it. If you finish early, you can send it to me and I can help you optimize it.

**Please email me your solution as an attachment named `match_calculator.py`.

Demo the Solution!

I've already completed the assignment and placed a compiled python binary in my home directory. To run it:

```
cd /home/alberthwang/python/final_exam_demo
python match_calculator.pyc
```

Please run this file to see how your solution should perform. If you are at all unclear about the premise of the assignment, running this file will help clarify.

Context (Fictional)

Google is starting a new 401(k) contributions matching program. Depending on the employee's home office location, Google will now match the employee's contribution by a certain amount (determined by a multiplier). To help process these contributions, Google has hired an army of Analysts and has asked you to make a tool for them. Management has asked you to make a command line tool that takes 2 inputs - an office location and a contribution amount. Based on that, the tool should calculate the total matching amount.

Data

In this fictional data set, each office has its own contribution multiplier (worksheet: data).

office	region	multiplier
US-MTV	N.America	100

Since the multiplier data is sensitive, management wants to limit who can see what. Thus, only certain Analysts can access certain multipliers. Permissions to the multipliers is mapped by the Analyst's manager's ldap (worksheet: access_control).

managerldap	region
frankwagner	EMEA
gwatters	N.America

To audit the data later, the tool also needs to log all the transactions that the Analysts make on the tool (worksheet: logs).

ldap	office	multiplier	contribution	total match	timestamp
alberthwang	US-MTV	100	120	12000	3/14/2011 15:21:22

Please build the tool listed described above with the following features.

Invalid Login (5 pts)

When the Analyst logs in to use the tool, they should be prompted for their ldap and password. Since we all occasionally mis-type our password, it should continue prompting the Analyst for his/her ldap & password until they get it right. **As a security precaution, the tool should only allow 3 tries.** If the user fails to login after 3 incorrect tries, the tool should force them to exit.

```
ldap: alberthwang
password:
Incorrect username/password...try again.
ldap: alberthwang
password:
Incorrect username/password...try again.
ldap: alberthwang
password:
What office are you calculating for?
```

Office Validation (15 pts)

Once logged in, the Analyst should be prompted to enter a 6 character office code.

```
What office are you calculating for?
```

Since the Analyst may enter the office code in the incorrect format, the tool needs to be able to anticipate and handle these clean these incorrect entries. All of these should be **valid** inputs for the office code 'US-MTV':

```
'us-mtv'
'  US-MTV '
'US MTV'
'US_MTV'
```

Once the office code has been cleaned, the tool should make sure that the office code is in the 6 character format LL-LLL where each L is a letter. If not, the Analyst should be prompted to enter a code in the proper format.

```
What office are you calculating for? US-THORNTON
Invalid office code format...must be in form LL-LLL.
What office are you calculating for? mountain view
Invalid office code format...must be in form LL-LLL.
What office are you calculating for?
```

In addition, since not all Google offices are listed in the data file - the tool should tell the Analyst when they've entered a valid office code but the office is not found in the data.

```
What office are you calculating for? IN-BLR
The office code IN-BLR is not in the data set.
What office are you calculating for? us cam
You have access to this data!
Enter a contribution amount:
```

Permissioning (10 pts)

Even though the Analyst enters a valid office code, they may not have access to it. When an Analyst tries to get data on an office they don't have permission to, the tool should thwart them.

```
ldap: alberthwang
password:
What office are you calculating for? JP-TOK
You do not have access to JAPAC...try another office
What office are you calculating for? UK-LON
You do not have access to EMEA...try another office
What office are you calculating for? US-MTV
You have access to this data!
Enter a contribution amount:
```

Calculating Total Match (5 pts)

If an Analyst has permission to view a multiplier, the tool should calculate the total match amount.

total match = contribution amount * multiplier

```
ldap: alberthwang
password:
What office are you calculating for? US-MTV
You have access to this data!
Enter a contribution amount: 120
The total match after applying the multiplier is 12000
Thanks for using the contributions tool!
```

Invalid Contribution Checking (5 pts)

Since Analysts can enter any information into the contribution line, the tool needs to make sure that they entered a valid integer. The tool should alert the user if they entered an invalid contribution and continue to do so until they get it right.

```
ldap: alberthwang
password:
What office are you calculating for? US-MTV
You have access to this data!
Enter a contribution amount: thirty two
Not a valid integer contribution amount...try again.
Enter a contribution amount: werasdd
Not a valid integer contribution amount...try again.
Enter a contribution amount: 20
The total match after applying the multiplier is 2000
Thanks for using the contributions tool!
```

Logging (10 points)

If everything goes well, right before the tool displays the total matching amount it should log the transaction in the final worksheet of the trix (worksheet: logs). As seen above, the logged row should look like this:

ldap	office	multiplier	contribution	total match	timestamp
alberthwang	US-MTV	100	120	12000	3/14/2011 15:21:22

The last column, **timestamp**, should have precision up to the second that the transaction happened and be added in the exact format that you see above (note that there is no line break in the actual timestamp, It just wrapped because it's too long). For fun try looking up the strftime() in python and figure out how to use it for this (but you don't have to).

Good luck - MAY THE FORCE BE WITH YOU.