Review Problems.

First, work problems 1, 2, 5 and 6 by hand first, without using your computer. Ignore problems 3, 4 and 7 for now, but do try to work them at home when you are studying for the exam.

Second, check your answers: I have provided a file on the website containing the code for these problems, packaged in functions, so you can see what the code does. (For problem 1, calling this function will print out the values and the types of all the expressions.)

Finally, and most importantly: What did you get wrong? Do you see what was behind the error you made? Do you understand why the correct answer is correct, and yours was not?

1. For each of the following expressions, determine the value and the type. (For type, the answer will always be int, float, str or bool or list). If the question consists of a sequence of statements, give the value and the type of the expression on the last line.

   (a) \(3/2+5.0\)
   (b) \(2**3*2\)
   (c) 'ade' > 'fab'[1:]
   (d) 'ba'*5+'b'
   (e) \(x=7\)
       \(y=3\)
       \((y*y>x)\) and \((2*y != x)\)
   (f) \(\text{len('abcdef')/3}\)
   (g) \(v = ['C', 'o', 'm', 'p', 'u', 't', 'e', 'r', 's']\)
       \(v[7:] + v[1:6] + v[:1]\)
   (h) \(6\) in \([2*x \text{ for } x \text{ in range(10)} \text{ if } x\%2==1]\)

2. Consider the following function definition:

   ```python
   def f(x):
       y = ''
       for c in x:
           if not (c in 'aeiou'):
               y = y+c
       return y
   ```

   What is the result of executing the following statement?
print(f('University of Michigan'))

What would be the result if the code were written incorrectly, and return statement were indented one more stop (under the if) or two more stops (under the assignment statement y=y+c)?

3. The following fragment of code sets a variable result to a boolean value. Write a single boolean expression, using ands, ors and nots but no ifs, that has the same value as result. It might be helpful to draw a picture of the set of points where result is True.

    if x>7:
        if x<=9:
            result=False
        else:
            result = True
    else:
        if x<-3:
            result = False
        elif x<4:
            result =True
        else:
            result=False

4. Write a fragment of code (it doesn't have to be a complete function) that takes a string s, say 'oyster', and prints a pattern like the following:

    o o o o o o
    o y y y y y
    o y s s s s
    o y s t t t
    o y s t e e
    o y s t e r

    Your code should work for any value of the initial string s.
5. The following code is meant to print out all powers of 3 less than one million (1000000), beginning with 3. Due to a small error, the actual output is not exactly as specified. What does the program really print, and how can you fix the error?

```python
def g(n):
    count = 0
    while n%3 == 0:
        n=n//3
        count +=1
    return count

x=g(48)-g(36)
```

(a) What is the value of the variable x after execution of the statement

(b) Give a succinct description of what exactly this function is calculating. (By this I mean, do NOT tell me what the code is doing, but rather describe the relation between the argument n and the value returned. 'The function returns the smallest prime factor of n' is a succinct description (although not correct, in this case); 'the function repeatedly divides n by larger and larger integers until a divisor is found' is what I DON'T want.)
7. The following program is meant to determine the length of the shortest side of a triangle whose vertices are entered in response to the prompts. This is done by repeated calls to a function \texttt{dist} that is supposed to compute the distance between two points:

\[ d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \]

There are several errors in both the function and the main program section. Find them and correct them. (Do not correct by changing to the built-in square root function; I still want you to compute the square root as the one-half power.)

```python
def dist(x1, y1, x2, y2):
    xdiff = x1 - x2
    ydiff = y1 - y2
    diff_squares = xdiff**2 + ydiff**2
    print(diff_squares**1/2)

x1 = input('Enter the x coordinate of the first vertex.
')
y1 = input('Enter the y coordinate of the first vertex.
')
x2 = input('Enter the x coordinate of the second vertex.
')
y2 = input('Enter the y coordinate of the second vertex.
')
x3 = input('Enter the x coordinate of the third vertex.
')
y3 = input('Enter the y coordinate of the third vertex.
')
d1 = dist(x1, y1, x2, y2)
d2 = dist(x1, y1, x3, y3)
d3 = dist(x2, y2, x3, y3)
print(min(d1, d2, d3))
```

8. The following statements are executed:

\[
\begin{align*}
x &= [3.5, -9, 2.0, 6.7, 4, 2] \\
y &= ['3.5', '-9', '2.0', '6.7', '4', '2']
\end{align*}
\]

Answer the following questions about \(x\), and \(y\). In each case, assume that \(x\) and \(y\) are as given in the above assignment statements; in other words, don’t assume that \(a, b,\) and \(c\) have already been executed before answering \(d\). In some parts, if the question asks you what happens when a particular statement is executed, the right answer might be 'it results in an error'.

(a) What is the type of \(y\)?

(b) What is \(\text{sum}(x[:2])\)?

(c) What are \(\text{len}(y)\), \(\text{len}(y[2])\) and \(\text{len}(y[2][2])\)?
(d) What is the value of x after the following statement is executed?
\[ x = x + 3 \]
(e) What is the value of x after the following statement is executed?
\[ x.append(3) \]
(f) What is the value of y after executing the following statement?
\[ x = x + [1, 6, -19.5] \]
(g) What is the value of y after executing the following statement?
\[ y[2][1] = '8' \]
(h) What is the value of y after executing the following statement?
\[ y.sort() \]
(j) and the following?
\[ y = y.sort() \]

9. Consider the function prob2 defined below:

```python
def prob2(nums):
    u = [[int(math.sqrt(x)), x] for x in nums]
    v = [y for y in u if y[0]**2 == y[1]]
    return [y[1] for y in v]
```

Suppose we call \( \text{prob2}(x) \), where \( x \) is the list

\[ [11, 11, 17, 9, 3, 5, 8, 11, 9, 14, 14, 2, 3, 13, 13, 6, 1, 8, 7, 6] \]

(a) What are the first three elements of the list \( u \) created in the first statement of the function?

(b) What are the first three elements of the list \( v \) created in the second statement of the function?
(c) What is the value returned by the function?

(d) Give a succinct description of what prob2(nums) returns in general, when nums is a list of integers.