

NYU Tandon School of Engineering
Brooklyn, NY 11201

CS-UY 1114 Intro to Programming & Problem Solving

First Midterm Exam – 25 October 2022

Name: Sahil Singh

NetID (first part of NYU email): SKS1379

Exam Seat Number: E1

- Duration: 1 hour and 15 minutes
- **DO NOT WRITE ON THE BACK OF ANY PAGE!**
- **Do not separate any page.**
- Please do not use pencil, if you must, write darkly, these pages will be scanned
- If you believe there is an error, please write **ERROR** for your answer
- If you write an answer other than in the space provided, please indicate, in the space provided, where we can find that answer
- This is a closed book exam; no calculators are allowed
- You can expect that the user inputs the appropriate values (int/float/etc where required).
- Comments are not required
- Anyone found cheating on this exam will receive a zero for the exam.
- Anyone who is found writing after time has been called will receive a zero for this exam.
- Do not open this test booklet until you are instructed to do so.
- If you have a question, please ask the proctor of the exam!
- You may use ONLY the following Python constructs and functions:

(all math operators)	if, elif, else	for
(all conditional operators)	while	ord
math.* (all in math module)	int/float	chr
random.* (all in random module)	print	input
str.* (all string methods)	len	str

- For reference, the point distribution for each question is below:

Question 1 - 12 points
Question 2 - 15 points
Question 3 - 15 points
Question 4 - 28 points
Question 5 - 30 points

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2⁴ + 2³2³^c
2²²
10

1. (12 points), Fill in the blanks to convert the following numbers

Decimal (base 10)	Binary (base 2)	Hexadecimal (base 16)
24	11000	18
79	0100 1111	4F
74	0100 1010	4A

2. (15 points), Trace the output of these nested loops

$$2^6 + 2^3 + 2^1 = 64 + 8 + 2 =$$

```
outer_limit = 5
for outer_var in range(2, outer_limit):
    inner_var = 100
    while inner_var > 10:
        print("inner: ", inner_var)
        inner_var //= outer_var
    print(inner_var)
```

Output:

inner: 100 (2, 5)
50
inner: 50
16
inner: 16
4
inner

$$\begin{array}{r} 50 \\ \times 3 \\ \hline 16 \end{array}$$

3. (15 points), Evaluate the conditional expressions given the following constants

```

test_str = "New York"
test_int = 42
first = True
second = False

```

a. not (first or second)	True	False
b. test_int >= 41 and not second and first	True	False
c. 1 <= test_int % 2	True	False
d. test_str < "New Jersey"	True	False
e. first or second and test_int > 100	True	False

T F

a) $\text{not}(T \text{ or } F) = \text{not}(T) = F$

b) $F \text{ and } T = F$

c) $\text{test_int \% 2} = 0$
 $1 > 0$

d) $\text{test_str} = "New\ York"$

F

e) $T \& F$

F

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4. (28 points), *Testing for powers.* We would like to design a program which can test a given number to see if it is a power of any base. For example, if you were given the number 16, you could indicate that this is both a power of 2 (2^4) and a power of 4 (4^2). Given 64, you could say it can be produced with bases 2, 4 and 8 (2^6 4^3 8^2). For this problem, we're not concerned about what power produces our number, just the base.

Write a program which will ask the user for a value and will produce all of the bases which can be used to make that value. If there are no bases, you should print nothing.

Below are a few sample runs of our program.

Enter a value: 16 Base found: 2 Base found: 4 Done	Enter a value: 64 Base found: 2 Base found: 4 Base found: 8 Done
Enter a value: 1 Done	Enter a value: 42 Done
Enter a value: 100 Base found: 10 Done	Enter a value: 625 Base found: 5 Base found: 25 Done

(please answer on the next page)

(Answer to Question 4)

```
root=0
value = int(input("Enter a value :"))
root_1 = 6.99
root = math.sqrt(value)
if value > 1:
    while True:
        if root * root == 0:
            print("Root is zero")
            break
        else:
            print("Root is", root)
            value = root
            root = math.sqrt(value)
    print("Done")
```

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(additional space for question 4)

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5. (30 points), New York state has a number of odd rules about paying employees. First, anyone who works more than 8 hours a day is paid overtime (1.5x pay rate) for the time in excess of 8 hours. For example, if you work 9 hours, you get paid 9.5 times your pay rate. (NYS law is 40 hours per week but, for this problem, we're focusing on *one day* for ease in this problem)

However, there are some additional rules that might impact your pay:

- *Basic minimum wage* is \$15/hour in New York City.
- *Spread of hours*: Any employee whose workday ends more than 10 hours from their workday start time is paid one extra hour of basic minimum wage
- *Split shift*: Any employee whose work day is divided into two parts with more than 1 hour in between, is paid one extra hour at basic minimum wage
- Either split shift or spread of hours rule may apply to any workday, but *not both!*

For this task, you will write a program which asks the user for their pay rate, the start and end times of their first and second shifts (for ease, you can treat these like floats as a number of hours since midnight, i.e. *1:15pm would be listed as 13.25, 3:30pm as 15.50, etc.*). Apply the above rules and print the amount that the person will be paid for that day. You can assume that all inputs will be valid and logical numerical values for a day's calculations. If the person didn't work a second shift, they will enter 0 for the start of their second shift.

Sample runs are below (with notes in *italics*)

<pre>pay rate? 20 start of first shift? 9 end of first shift? 17 start of second shift? 0 Total Pay: \$160.0 <i>(8 hours worked, 1 shift)</i></pre>	<pre>pay rate? 15 start of first shift? 10 end of first shift? 12 start of second shift? 13 end of second shift? 15 Total Pay: \$60.0 <i>(4 hours worked, two shifts)</i></pre>
<pre>pay rate? 30 start of first shift? 10 end of first shift? 12 start of second shift? 14 end of second shift? 16 Total Pay: \$135.0 <i>(4 hours worked, split shift)</i></pre>	<pre>pay rate? 100 start of first shift? 9.5 end of first shift? 10.5 start of second shift? 11 end of second shift? 20 Total Pay: \$1115.0 <i>(8 hours regular, 2 hours overtime, with spread of hours)</i></pre>
<pre>pay rate? 20 start of first shift? 10 end of first shift? 12 start of second shift? 14 end of second shift? 22 Total Pay: \$235.0 <i>(8 hours regular, 2 hours overtime, with split shift and spread of hours but not both)</i></pre>	<pre>pay rate? 20 start of first shift? 10 end of first shift? 19 start of second shift? 0 Total Pay: \$190.0 <i>(8 hours regular, 1 hours overtime)</i></pre>

(Please start your answer on the following page)

(Answer to Question 5)

$$\begin{aligned} \text{spread} &= 0 \\ \text{overtime} &= 0 \\ \text{rate} &= \text{float}(\text{input}(" \text{ pay rate? } ")) \end{aligned}$$

$$\text{start_1} = \text{float}(\text{input}(" \text{ start of first shift? } "))$$

$$\text{end_1} = \text{float}(\text{input}(" \text{ end of first shift? } "))$$

$$\text{start_2} = \text{float}(\text{input}(" \text{ start of second shift? } "))$$

$$\text{end_2} = \text{float}(\text{input}(" \text{ end of second shift? } "))$$

$$\text{Shift_1} = \text{end_1} - \text{start_1}$$

$$\text{Shift_2} = \text{end_2} - \text{start_2}$$

$$\text{Shift} = 0$$

while $\text{start_2} \neq 0$:

$$\text{end_2} = \text{float}(\text{input})$$

$$\text{Shift} = \text{start_1} / \text{float}()$$

$$\text{end_1} = \text{start_2} / \text{float}()$$

$$\text{overt} = 0$$

$$\text{Total} = 0$$

$$\text{total} = 0$$

if $\text{start_2} - \text{end_1} > 0$:

$$\text{spread} = (\text{start_2} - \text{end_1}) / 1$$

if $\text{end_1} - \text{start_1} > 8$:

$$\text{overtime} = \text{end_1} - \text{start_1} - 8$$

$$\text{shift_1} = \text{shift_1} - \text{overtime}$$

elif $8 \geq \text{end_1} - \text{start_1} > 0$:

$$\text{shift_1} = \text{shift_1}$$

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(additional space for Question 5)

overtime-2 = 0

if end-2 - start-2 > 8:

overtime-2 = end-2 - start-2 - 8

shift-2 = shift-2 - overtime-2

elif 8 <= end-2 - start-2 > 0:

shift-2 = shift-2

Shift = Shift-1 + Shift-2

Over = overtime + overtime-2

Total = Pay rate * Shift + Pay rate * 3/2 * over

Total = float(total) + 15 * spread

print("Total pay: \$", Total)

Name _____

Net ID: _____

(Additional Space)