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ECE 1020: Introduction to Programming
Mid-term test
15 Feb 2022

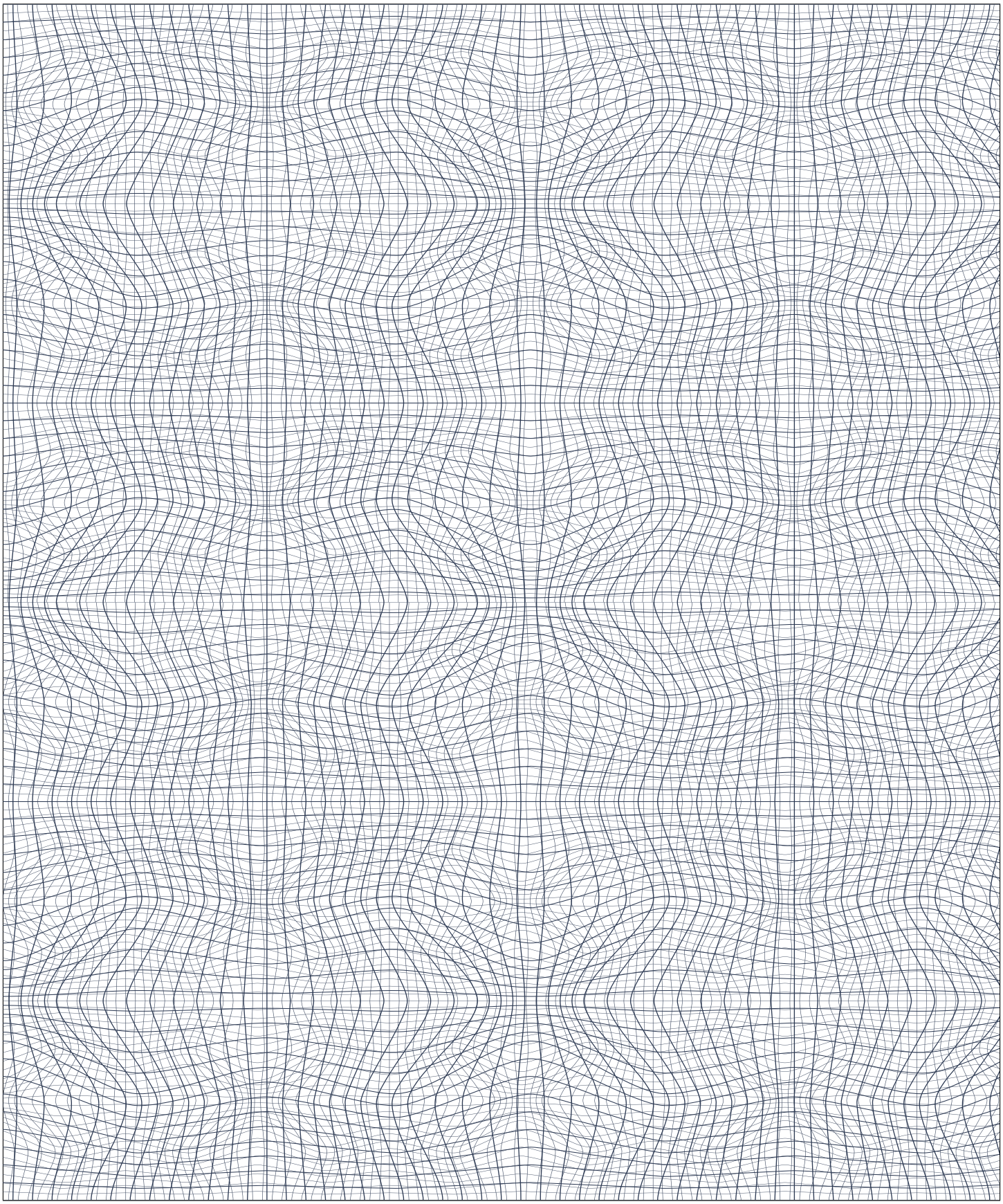
Name:

Student ID:

Instructions

1. Answer all questions.
2. Write your answers in the space provided on this paper.
3. Write your student number at the top of every answer page.
4. This is a closed-book exam: written aids are not permitted.
5. Calculators, phones and all other electronic aids are not permitted.
6. Unless otherwise specified, all code listed in this exam compiles and executes correctly.

Question:	1	2	3	4	5	6	Total
Points:	10	8	12	3	5	12	50
Score:							



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Programming concepts

1. Match the terms on the left to the appropriate descriptions on the right. There are more descriptions than terms: only match each term **once**. [10]

a. assignment
b. comment
c. increment
d. integer
e. keyword
f. literal
g. memory
h. type

_____ a sequence of characters
_____ result of `//`
_____ increasing an integer by one
_____ putting a value in a variable
_____ only has one operand
_____ combining addition and assignment, for instance
_____ where a computer stores information
_____ kind of value
_____ an identifier reserved by the language
_____ true or false
_____ for humans, not the computer
_____ a value that means exactly what's written

2. Programming types [8]

What type(s) of variable (e.g., integer) would you choose to represent each of the following values? **Justify your choice** in a few words (complete sentences not required). There may be more than one correct answer.

(a) Number of books on a shelf [1]

Solution: `int` (no part books)

(b) Names of books on a shelf [1]

Solution: `list`

(c) Cost of a textbook [1]

Solution: `float` dollars or `int` cents

(d) Number of students in a course [1]

Solution: `int`

(e) Hours spent on a course per week [1]

Solution: `int` or `float`

(f) My cat's name [1]

Solution: `string`

(g) My cat's weight [1]

Solution: `float` kg, `int`, etc.

(h) A musical note [1]

Solution: `char` for note name, `float` for frequency or some other justified type (or combination!)

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Program analysis

3. Determine how the following Python code will behave. **[12]**

   (a) What will the following Python script print when it is run? 4

```
print('A:', type(7e3))
print('B:', type(1 / 2) == type(1 % 2))
print('C:', type('C'))
print('D:', type(1_000))
```

Solution:

```
A: <class 'float'>
B: False
C: <class 'str'>
D: <class 'int'>
```

   (b) What will the following Python script print when it is run? 8

```
x = 20

while x > 10:
    y = x * 3
    z = y // 10

    print('x:', x)
    print('y:', y)
    print('z:', z)

    x -= z
```

Solution:

```
x: 20
y: 60
z: 6
x: 14
y: 42
z: 4
```

Program synthesis

4. Last week, there was something of a breakthrough in the development of energy via nuclear fusion[1]. This serves as a reminder of the potential for generating vast quantities of clean energy, but also of the difficulties of managing the process. The energy released by a fusion reaction can be described by: [3]

$$E = (m_2 - m_1)c^2$$

where m_1 is the reaction mass before the fusion reaction, m_2 is the mass of the reaction products and c is the speed of light. Given variables `m1`, `m2` and `c = 299_792_458`, write a Python expression for the energy released by a fusion reaction.

Solution:

```
(m2 - m1) * c**2
```

5. Draw a flowchart corresponding to the following Python script: [5]

```
drink = input("What would you like to drink? ")

bottles = 99
while bottles > 0:
    print(bottles, 'bottles of', drink, 'on the wall')
    bottles = bottles - 1

print('No more bottles of', drink, 'on the wall')
```

Solution:

[1] Jonathan Amos, "Major breakthrough on nuclear fusion energy", BBC News, 9 Feb 2022. Available at: `https://www.bbc.com/news/science-environment-60312633`

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6. Something we've fortunately not had to worry much about this semester has been significant amounts of snowfall leading to cancellations. However, we should be aware of the possibilities! Environment Canada issues a Snowfall Warning whenever 15 cm of snow or more falls within 12 hours or less. If 25 cm are expected to fall within a 24 h period, a Winter Storm Warning is issued instead. [12]

   Write a Python script that will prompt a user for a snowfall amount, as well as when a storm starts and stops (to the nearest hour). It should then print what kind of warning (if any) Environment Canada should issue.

Solution:

```
amount = int(input('Snowfall amount> '))
start_time = int(input('Start hour> '))
end_time = int(input('End hour> '))
days = int(input('Days> '))

hours = end_time - start_time + 24 * days

if amount >= 25 and hours >= 24:
    print('Winter Storm')

elif amount >= 15 and hours >= 12:
    print('Snowfall')
```