

**University of Toronto
Faculty of Arts and Science**

April 2012 Examinations

CSC 104H1S

Duration: 3 hours

No aids allowed

Last name:

First name(s):

Student number:

Make sure you have all 11 pages (including this page).
(Don't panic about the page count—there's lots of space for answers.)

Answer *all* questions. Answer questions in the space provided. Answers not in the correct space might not be graded unless a note in the correct space says “see page ...” and the answer on that page is clearly labelled with the question number.

Be careful not to get stuck on some questions to the exclusion of others. The amount of marks or answer-space allotted does not indicate how long it will take you to complete the question, nor does the size of the answer-space indicate the size of the correct answer.

Do not open this booklet until you are instructed to.

Do not write anything in the following table:

question	value	grade	question	value	grade
1	9		7	10	
2	10		8	15	
3	6		9	6	
4	5		10	5	
5	5		11	12	
6	9		12	8	
subtotal			total	100	

1. [9 marks]

Brookshear's definition of an algorithm includes, among other attributes, that the steps are unambiguous, that they are executable, and that the process terminates.

For each of these criteria, give an example of ordinary instructions which fail to qualify as an algorithm by not meeting that criterion, and indicate how the instructions can be repaired so as to qualify as an algorithm.

a) Example ordinary instructions which don't qualify as an algorithm because they are ambiguous:

Revised instructions which do qualify as an algorithm:

b) Example ordinary instructions which don't qualify as an algorithm because they are not executable:

Revised instructions which do qualify as an algorithm:

c) Example ordinary instructions which don't qualify as an algorithm because the process of following the algorithm does not terminate:

Revised instructions which do qualify as an algorithm:

2. [10 marks]

On the CDF computers, how do you (answer *very* briefly; assume that a terminal window is open but no other programs are running):

a) open the file named “foo” in the current directory using the “gnnumeric” spreadsheet program?

b) display, in a terminal window, the contents of the file named “bar” in the current directory?

c) display, in a terminal window, the contents of the file named “bleep”, when that file is in your home directory, but your current directory is *not* your home directory?

d) execute the Python program named “bloof”, which is in a directory named “/u/ajr/104/exam”?

e) create a new directory named “blap” as a subdirectory of the directory named “qwerty”, where qwerty is a subdirectory of your current directory?

3. [6 marks]

a) What is the difference in **syntax** between an absolute path name and a relative path name? (I.e. how do you write it?)

b) What is the difference in **semantics** between an absolute path name and a relative path name?

4. [5 marks]

Some traditional mathematical or arithmetical symbols are not part of the ASCII character set, so we have other ways to write them in Python, using symbols which *are* part of the ASCII character set.

For each of these symbols, answer ‘yes’ or ‘no’ as to whether they are in the ASCII character set (which in this case is the same as the question as to whether or not you can type them on your computer keyboard), and if they aren’t, write what symbols we use to express the idea in Python.

symbol	In ASCII?	What Python uses instead
=		
<		
≤		
≠		
+		
¬ (boolean ‘not’)	no	
second number is raised, indicating exponentiation	no	

5. [5 marks]

a) Write a 'for' loop in Python to print your name 1000 times.

b) Explain your use of 'range' in the 'for' statement you used in part a. What value does 'range' generate there? What is expected at that point in a 'for' statement in Python (i.e. after the 'in' keyword)?

6. [9 marks]

a) What does the following Python program output?

```
if 2+3*8 > 35:
    print 'Wilma'
else:
    print 'Betty'
```

b) What does the following Python program output?

```
x = 5
while x < 10:
    print x
    x = x + 2
```

c) What does the following Python program output?

```
for i in range(5,10):
    print i*2
```

7. [10 marks]

Write a Python program to print the following output, using a loop. Note that the “13” line is missing below.

```
10 times 3 is 30
11 times 3 is 33
12 times 3 is 36
14 times 3 is 42
15 times 3 is 45
16 times 3 is 48
17 times 3 is 51
18 times 3 is 54
19 times 3 is 57
20 times 3 is 60
```

8. [15 marks]

On the next page is a spreadsheet keeping track of someone’s deposits to an interest-bearing account. The user of the spreadsheet enters values in the table at the top (C1 through C4), and enters the deposits in column B in the years where they are applicable. (Remember that a blank cell counts as a zero in a numeric formula, so all blank deposit years are deposits of zero.)

8, continued

	A	B	C	D	E
1	start year		2010		
2	annual interest rate		1.2		
3	first tax year		2015		
4		tax rate	15		
5					
6	year	deposit	interest	balance	tax owing
7	2010	10.00	0.00	10.00	0.00
8	2011		0.12	10.12	0.00
9	2012		0.12	10.24	0.00
10	2013	1000.00	0.12	1010.36	0.00
11	2014		12.12	1022.49	0.00
12	2015		12.27	1034.76	1.84
13	2016		12.42	1047.18	1.86
14	2017	500.00	12.57	1559.74	1.88
15	2018		18.72	1578.46	2.81
16	2019		18.94	1597.40	2.84
17	2020		19.17	1616.57	2.88
18	2021		19.40	1635.97	2.91
19	2022		19.63	1655.60	2.94
20	2023		19.87	1675.47	2.98

The spreadsheet calculates the interest earned on the deposits and the new balances. Note that the interest is on the *previous* year's balance; so C7 is always going to be zero, and C8 is the interest on D7 (not on D8).

Note that the values in cells C2 and C4 are percentages (i.e. divide by a hundred).

The values in column A are also formulas. If you were to change the value in C1, the years from A7 to A20 would all automatically change accordingly.

And there is an income tax payable on the interest, only starting from a year specified in cell C4. So the tax owing prior to this year is always zero, and then as of the C4 year, the tax is the percentage of the interest indicated in cell C4. The tax in a given year does not feed into any of the other cells any further.

Write the formulas for these cells as directed below, in the style of a spreadsheet program such as Gnumeric.

A7:

A8 (to be copied down):

C7:

C8 (to be copied down):

D7 (to be copied down):

E7 (to be copied down):

9. [6 marks]

When your web browser makes a TCP connection to `www.cdf.toronto.edu`, it uses the IP address `128.100.31.101` and the port number `80`.

a) What is `128.100.31.101` used for? (What is its function?)

b) Where does your web browser get the `128.100.31.101` from?

c) What is the number `80` used for? (What is its function?)

d) Where does your web browser get the number `80` from?

10. [5 marks]

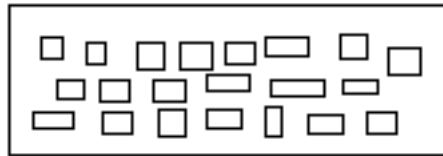
In this course we have been writing HTML using the “structural” tags only. What is the advantage to this approach?

11. [12 marks]

Write HTML code to produce the web page shown below. Use only structural tags except for the indication of italics; and otherwise follow all of the principles taught in CSC 104. This is part of a series on computer programming.

How to type

First, find your computer keyboard. It's probably on your desk somewhere. It looks like this:

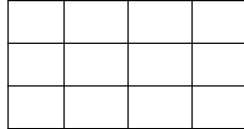


Next, press the keys corresponding to the formula you read in the book. For example, suppose the book says " $c = \pi d$ ". Good luck finding *that* on your keyboard!

The picture of a keyboard can be found at <http://www.computerparts.info/keyboard.png> and the character π (often spelled "pi" in English typing) can be found at <http://www.mathchars.ca/pi.gif>

12. [8 marks — difficult]

Use the Bresenham line algorithm to state which pixels should be filled in to draw a line from the top-left to the bottom-right of this grid of pixels:



Show your calculations. Please call the top-left pixel (10,10) and the bottom-right pixel (13,12). Thus $dx = 3$ and $dy = 2$.

And recall the error calculation statement: `error = error + float(dy) / dx`

Extra space if needed
(you must write “see page 11” in the usual answer space for the given question)

End of exam. Total marks: 100. Total pages: 11.

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