

UBC CPSC 100: Computational Thinking Midterm Exam October 25, 2021

Instructions:

1. Please place your UBC student ID on the table now to allow us to check attendance.
2. Do not open this test until told to do so. Write your name, cwl and student number on this page now.
3. This exam is DOUBLE-SIDED.
4. You will have 90 minutes to complete this exam.
5. DO NOT DETACH ANY PAGES from this exam.
6. NO OUTSIDE MATERIAL, such as books or calculators, may be used.
7. Enter your answers legibly IN THE BOXES PROVIDED only.
8. If you need extra space, please enter your answers only on the “Additional Answers” page and indicate in the original answer to look there.
9. Page 11 has useful information that may help you to answer some problems
10. SCRATCH OUT any errors and rough work that shouldn't be marked.
11. If you are in any doubt about understanding any part of a question, STATE YOUR ASSUMPTIONS.
12. Point values for each question are indicated. Aim to spend less than one minute per point.
13. Good luck! 🍀

Point values of questions:

Question	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
Points	2	3	12	7	8	5	5	12	14	14	6	12	100

Name: _____

Student Number: _____

CWL: _____

Use the options below for questions 1 and 2

- A. Removing train tracks and school locations on a map showing bus routes
- B. Calling an iPod a “music player” instead of an “mp3 player”.
- C. Using the Internet without understanding how the computer accesses a website
- D. Writing a program in machine code (0s and 1s)

1. Which of the options listed above is NOT an example of abstraction? Enter one of A, B, C, or D in the box.

Correct answer is D.

2. For the option that you have identified in Question 1, demonstrate how it could be made more abstract. In other words, rewrite it so it is an example of abstraction.

Writing a program in a high-level language or even assembly code so that it can execute across different machine architectures is an example of abstraction.

Full marks for reasonable abstractions of other answers from Q1.







3. Consider the following numbers:

200 ₁₀	2B ₁₆	199 ₁₆	111011010 ₂	46 ₁₀	101000 ₂
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Arrange the numbers in ascending order, smallest number to the left, largest to the right. In other words, reorder the numbers based on their numeric value. You do not NEED to convert to a specific base.

101000 ₂	2B ₁₆	46 ₁₀	200 ₁₀	199 ₁₆	111011010 ₂

4. Sally sells seashells by the seashore, but only if the conditions are satisfactory. She only sells shells if there's sunshine. She also will only sell shells if there are no sandcrabs. Which of the following logical expressions represents when Sally sells seashells by the seashore? For the Snap blocks below, assume that **sunshine** and **sandcrabs** are Boolean variables.

A	
B	
C	
D	
E	
F	

For Question 4, select all options that apply. Enter all the letter(s) corresponding to the appropriate Snap blocks into the box below.

A and F for full points

E also correct, based on de-morgans law $\neg(A \text{ or } B)$ is $(\neg A) \text{ and } (\neg B)$
 so $(\neg(\text{sandcrab or not sunshine}))$
 $\neg \text{sandcrab and not not sunshine}$
 $\neg \text{sandcrab and sunshine (same as A and F)}$

5. As a photographer for World Wildlife Fund (an organization that raises awareness on wildlife conservation and endangered species), you often find yourself taking pictures, all around the continent. Currently, you are trying to determine what image representation to use so that you can send the pictures to your boss who is planning a wildlife conservation event. For the event, they plan to use your images for promotional materials and banners. Which image representation should you use and what is the limitation of your chosen representation?

Any of the following can be accepted with justification (full credit only given with reasonable justification):

- Vector (e.g., SVG, AI, EPS file formats) - can be justified by pointing out wide range of sizes of promotional material. Vector representations scale up without loss of detail.
- Lossless bitmap (e.g., PNG, TIFF formats) - can be justified by pointing out that lossless format will preserve image quality, to the pixel, no loss of detail.
- Lossy bitmap (e.g., JPEG format) - can be justified by pointing out that we need to significantly compress high resolution images to store and transfer them. Lossy bitmap representations offer better compression than lossless.
- General bitmap (lossy vs. Lossless not specified) - can be justified by pointing out images will contain lots of complexity and gradations of colour. Better to store colour of each pixel with bitmap representation.

Some appropriate limitations of each representation:

- Vector (e.g., SVG, AI, EPS file formats) - have difficulty representing complex scenes with many shapes and/or colour gradations. Can be slow to draw on a computer (compared to bitmap).
- Lossless bitmap (e.g., PNG, TIFF formats) - requires more storage space than lossy representations.
- Lossy bitmap (e.g., JPEG format) - loses details in image.
- General bitmap (lossy vs. Lossless not specified) - doesn't scale up as well to large sizes, will show pixelization (compared to vector formats).

Instructions for Questions 6 and 7. Based on what you have been exposed to in the course so far, identify whether the following statement is True or False. If the statement is false, explain what is false about the statement.

6. During a recent family conference call, your older brother proclaims that a computer is superior to humans because of the amount of data it can store, the speed at which it perform calculations, and the fairness of the algorithms it employs.

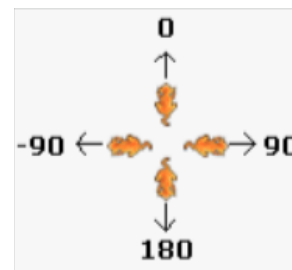
False – when it comes to fairness algorithms can also be biased
Bias exists because of the human designers' beliefs, bias in the data, unclear mode of evaluation

7. When using Notepad and Microsoft Word to store textual data, what you see is always what you get.

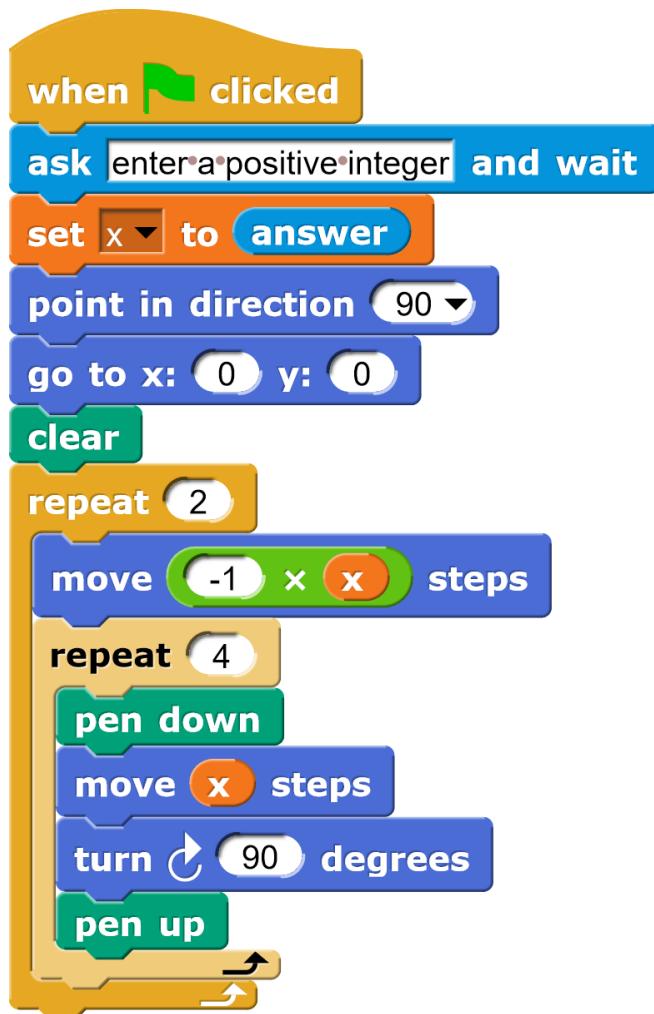
False – when use Microsoft Word what you see is not what you get, there is additional data that is stored in the file like styling, who wrote the file, when it was last edited
(Not required for full credit: Notepad is actually an ASCII text editor so WYSIWYG.)

8. What is the purpose of the following Snap block?

Hint from Snap's help:



(90) right
(-90) left
(0) up
(180) down



The purpose of the Snap! block is to ask for the length of a square and draws two squares with that side-length horizontally beside each other.

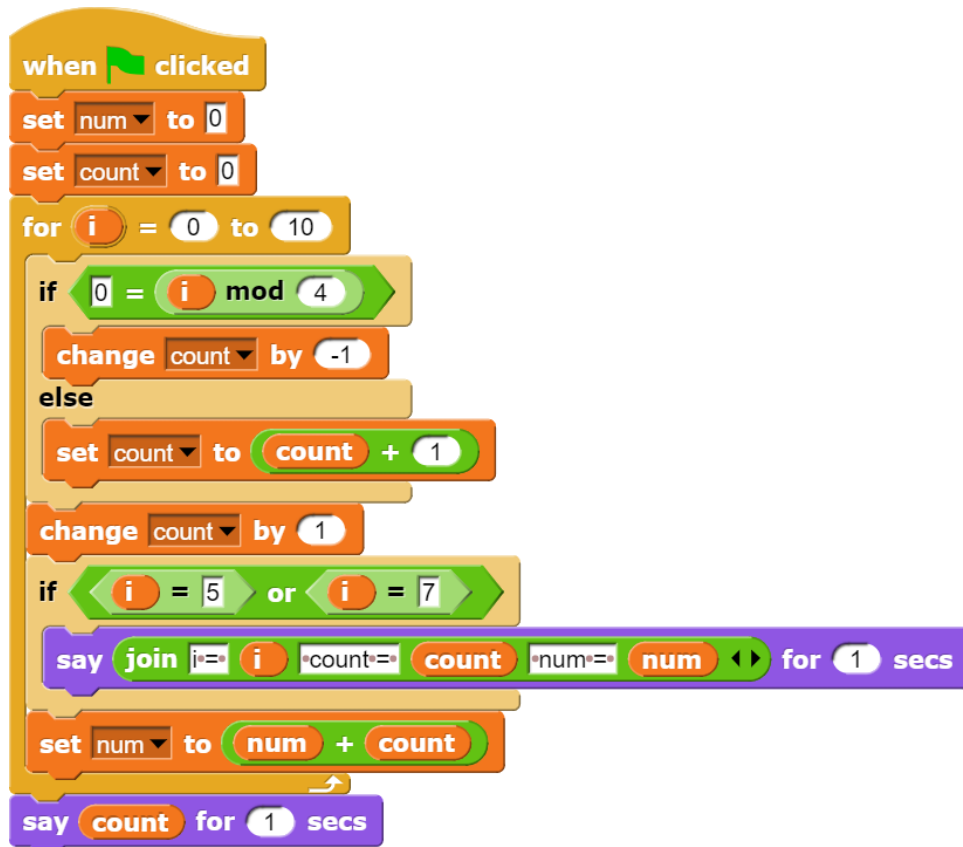
9. What does the sprite say when this program is run?

Hint from Snap's help:

mod

gives the remainder of the division of the two numbers.

For example, **143 mod 6** is 5 (143 divided by 6 is 23 and the remainder is 5)



Enter only what the sprite says in the box below.

i = 5 count = 8 num = 18

i = 7 count = 12 num = 36

16

10. In the context of what you have learned this term, what is the relationship between the concepts below?

Algorithm, Data, Bias, Snap, Computational Thinking, PNG

+3 for each good relationship found between: CT & Algorithm, Algorithm & Snap!, Algorithm & Data.

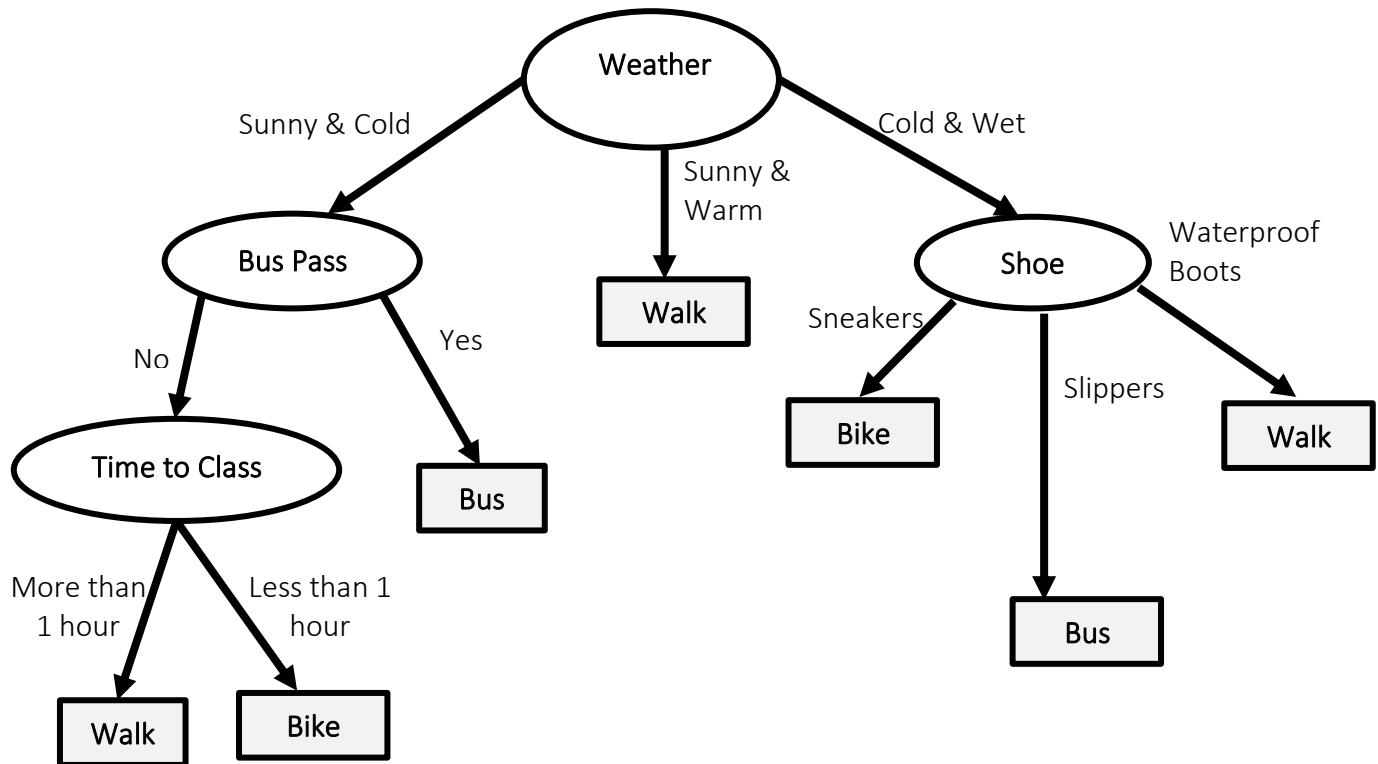
+2 for each good relationship found between: Algorithm & Bias, Bias & Data, PNG & Data, Algorithm & PNG, Snap! & Data.

Maximum 14 pts.

Some example relationships:

- *Computational Thinking* involves the thought processes for stating problems and their solutions, which can be written out as *Algorithms*.
- *Algorithms* can be converted into high-level programming languages like *Snap!*, that a computer can execute.
- *Data* can be used to train *Algorithms*.
- *Algorithms* can be used to process *Data*.
- *Algorithms* for ambiguous tasks may have *Bias*.
- *Bias* may arise from the sampled *Data*.
- *PNG* is a file format used to store image *Data*.
- Compression *Algorithms* can produce *PNG* images.
- A user can input *Data* into a *Snap!* program.

Use the decision tree to answer the questions 11 – 12. You are given the decision tree, but you may need to infer some things about the data table for the first question.



11. How many entropy calculations are required to build the tree above?

Either of the following accepted:

- 12 = 4 for first node, 3 for Sunny & Cold, 3 for Cold & Wet, 2 for Bus Pass No or
- 9 = 4 for first node, 3 for Sunny & Cold, 1 for Cold & Wet, 1 for Bus Pass No ("Cold & Wet" and "Buss Pass No" can be aborted early if we find zero entropy)

12. Write out the algorithm that corresponds to the given decision tree.

Write your answer on the following page

12. Write out the algorithm that corresponds to the given decision tree.

- Check to see what the weather is,
- if the weather is sunny & cold then check to see if there is no bus pass,
 - If there is no bus pass, then check to see whether time to class is greater than an hour
 - If it is greater than an hour, select the walk option
 - If the time to class is less than an hour then select the bike option
- If the weather is sunny & warm then select the walk option
- If the weather is cold & wet then check to see what kind of shoes
 - If the shoes are sneakers then select bike option
 - If the shoes are slippers then select the bus option
 - If the shoes are waterproof boots then select the walk option

Additional Answers

Use this page to add additional answers if need be. Clearly number your answers here and indicate to the grader in the original space for the answer to look here.

Information you may find useful

Do not enter answers here as this sheet will NOT be graded. (Use the previous “Additional Answers” page for extra space.)

Powers of two

2 raised to the power of	is
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512

Hexadecimal digits

Binary Representation	Hexadecimal representation
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Blank Page for Rough Work

Do not enter answers here as this sheet will NOT be graded. (Use the previous “Additional Answers” page for extra space.)