

THE UNIVERSITY OF BRITISH COLUMBIA
CPSC 100: MIDTERM EXAMINATION – October 17, 2019

Full Name: _____

Exam ID: _____

Signature: _____

UBC Student #: _____

Important notes about this examination

1. You have **90 minutes** to complete this examination.
2. This is a closed book, closed notes exam. No books or other material may be used.
3. Answer all questions on this paper. Give very short but precise answers. State any assumptions you make.
4. Work fast and do the easy questions first. Leave some time to review your exam at the end.
5. Put away books, papers, laptops, calculators, cell phones... everything but pens, pencils, erasers and this exam.
6. Good luck!

Student Conduct during Examinations

1. Each examination candidate must be prepared to produce, upon the request of the invigilator or examiner, his or her UBCcard for identification.
2. Examination candidates are not permitted to ask questions of the examiners or invigilators, except in cases of supposed errors or ambiguities in examination questions, illegible or missing material, or the like.
3. No examination candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination. Should the examination run forty-five (45) minutes or less, no examination candidate shall be permitted to enter the examination room once the examination has begun.
4. Examination candidates must conduct themselves honestly and in accordance with established rules for a given examination, which will be articulated by the examiner or invigilator prior to the examination commencing. Should dishonest behaviour be observed by the examiner(s) or invigilator(s), pleas of accident or forgetfulness shall not be received.
5. Examination candidates suspected of any of the following, or any other similar practices, may be immediately dismissed from the examination by the examiner/invigilator, and may be subject to disciplinary action:
 - i. speaking or communicating with other examination candidates, unless otherwise authorized;
 - ii. purposely exposing written papers to the view of other examination candidates or imaging devices;
 - iii. purposely viewing the written papers of other examination candidates;
 - iv. using or having visible at the place of writing any books, papers or other memory aid devices other than those authorized by the examiner(s); and,
 - v. using or operating electronic devices including but not limited to telephones, calculators, computers, or similar devices other than those authorized by the examiner(s)—(electronic devices other than those authorized by the examiner(s) must be completely powered down if present at the place of writing).
6. Examination candidates must not destroy or damage any examination material, must hand in all examination papers, and must not take any examination material from the examination room without permission of the examiner or invigilator.
7. Notwithstanding the above, for any mode of examination that does not fall into the traditional, paper-based method, examination candidates shall adhere to any special rules for conduct as established and articulated by the examiner.
8. Examination candidates must follow any additional examination rules or directions communicated by the examiner(s) or invigilator(s).

Please do not write in this space:



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Note that any work that you do on this page will NOT be graded.

General Instructions – The exam has twelve questions. Read each question carefully and answer in the space provided. For some questions, the answers MUST be written within the given box.

1. [4 points] Rank the following places where memory is stored in a computer from slowest (1) to fastest (4). Write your answer in the boxes provided:

Cache

Hard drive

RAM

Registers

2.

a. [1 point] Define abstraction

b. [1 point] Define decomposition

3. [4 points] As a member of a voter suppression organization that verifies fair elections in Canada, you have been charged with visiting a polling station and reporting on any questionable behavior that you observe. Nothing seems to be happening and so you get out your phone to monitor the election on Twitter. Two minutes later, you notice a person stuffing a ballot box with ballots. You take a picture of the person in question and immediately try to send the image to your boss. Unfortunately, the file is too big to be attached to an email, so you need to compress it. Explain the benefits and limitations of using either of the types of compression discussed in class.

4. [3 points] Consider the task of deciding which person/people in a class is the tallest. In the appropriate space below, please write (a) whether the task is ambiguous or unambiguous. Then (b) state why.

a. [1 point] Ambiguous or unambiguous? (please write your answer below)

b. [2 points] Why?

5. [6 points] Consider the three sorting algorithms (insertion sort, selection sort, and simple sort) that we discussed in class. Assume that you were using one of them to sort books that had been on a library shelf for a long time. These books are largely sorted in the correct order, but patrons have put a small number of them back incorrectly. Note that the description of the sorts is listed at the end of the exam.

a. [3 points] Which of the algorithms that we covered is the best algorithm to use? Why?

b. [3 points] Which of the algorithms that we covered is the worst algorithm to use? Why?

6. [4 points] Number conversions

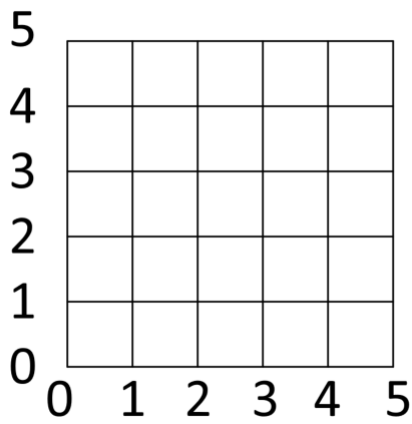
Please convert the following numbers. Show your work

a. [2 points] Convert decimal 54 to binary

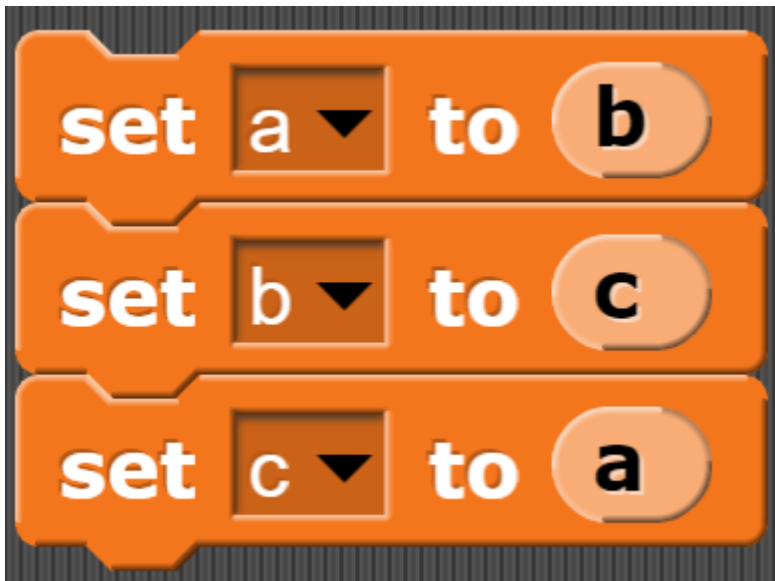
b. [2 points] Convert 0x111 to decimal

7. [3 points] What vector image is represented by the following sequence? Show your answer on the grid below.

0,5,2,1,1,2,4,3,0,5



8. [3 points] At a high level, what does this program do? (i.e., do not state what each step does, explain what the overall effect is. For example, you are looking for a description like “it sets all of the variables to the value of the lowest variable” Note that this is *not* the correct answer.)



9. [9 points] Consider a simplified version of the Hexadecimal digits chart on the last page. The top of that chart is reproduced here.

| Binary Representation | Hexadecimal representation |
|-----------------------|----------------------------|
| 0000 | 0 |
| 0001 | 1 |
| 0010 | 2 |
| ... | ... |

Write an algorithm that takes in an initial chart like the above and creates a new chart that has the hexadecimal representation before the binary representation. E.g., the start of the output should look like:

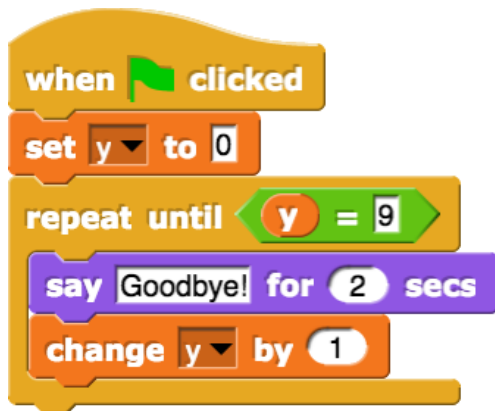
| Hexadecimal Representation | Binary Representation |
|----------------------------|-----------------------|
| 0 | 0000 |
| 1 | 0001 |
| 2 | 0010 |
| ... | ... |

Make sure that your algorithm works for any number of numbers (i.e., don't assume that it stops at 0XF)

Your algorithm should specify both the numbers and the **basic** formatting.

State any assumptions that you make. As a starting point, do not worry about font size, and assume the things that you need to write will fit inside the space provided. Do not worry about specifying the exact spacing.

10. [2 points] Consider the code:

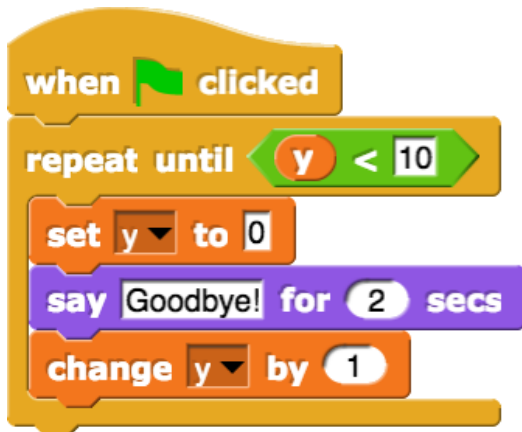


Which of the following have the same outcome as the code above? Write the letter(s) here:

A:



B:



C:



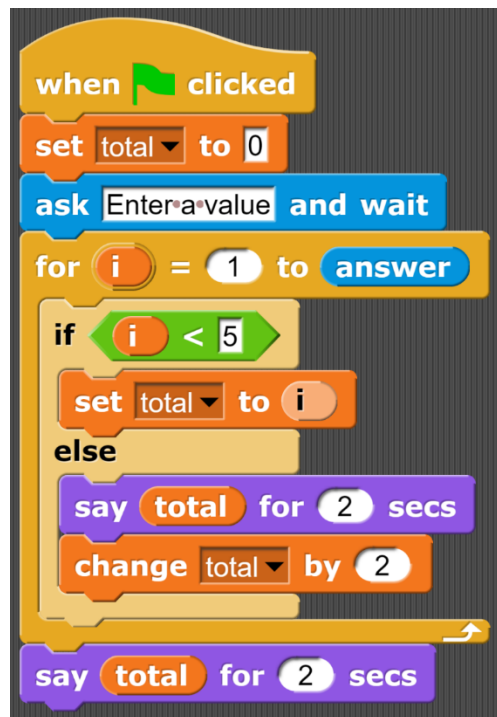
11. [5 points] What is displayed to the screen when this block is run and the user inputs the value 8?

Make sure that you show all values that are output. E.g., if the algorithm says “a”, then “b”, then “c”, your answer should be

a

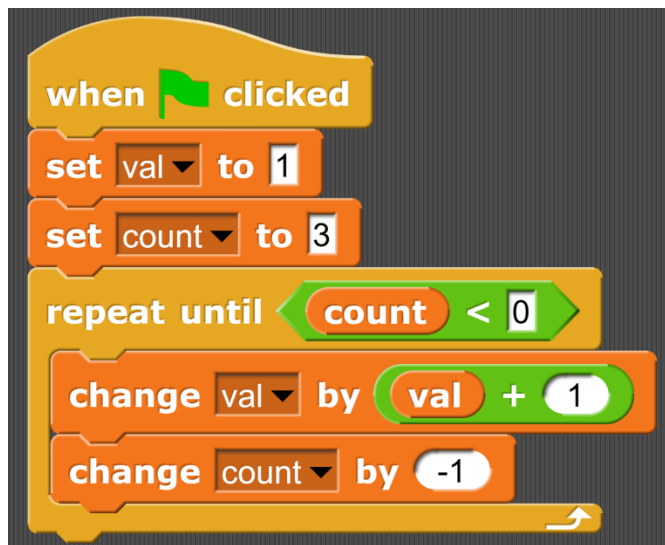
b

c



Write your answer in the box below

12. [5 points]



a [3 points] What is the value of the “val” variable after the block (shown above) has run?

Write your answer in the box below

b [2 points] What is the value of the “count” variable after the block (shown above) has run?

Write your answer in the box below

[illegible]

Information you may find useful. This sheet will NOT be graded.

Powers of two

| 2 raised to the power of | |
|--------------------------------|-----|
| 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 |

Information you may find useful. This sheet will NOT be graded.

Insertion sort:

1. Deal the unsorted cards
2. Put a divider after the first card
3. Repeat steps 4 through 6 until there is no card to the right of the divider
 4. Select the first card to the right of the divider. This is the “new” card.
 5. Swap this card to the left until it arrives at the correct sorted position
 6. Advance the divider to the right one card
7. Stop

Selection sort:

1. Deal the unsorted cards
2. Put a divider at the left of the unsorted cards
3. Repeat steps 4 through 7 until one unsorted card remains
 4. Initially mark the first (leftmost) card
 5. For each card to the right of the second card:
If the card is smaller than the marked card,
move the marker to the current card
6. Swap the marked card with the first unsorted card (just to the right of the divider)
7. Advance the divider to the right one card
8. Stop

Simple sort:

1. Place the unsorted cards in the top row
2. Repeat steps 3 through 6 until no unsorted card remains
3. Initially mark the first (leftmost) card
4. Working right from the second card, compare the marked card to the current card.
If the current card is smaller than the marked card,
Move the marker to the current card
5. Move the marked card to the sorted hand
6. Put a “Max” (upside down) card in the empty unsorted slot
7. Stop

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Note that any work that you do on this page will NOT be graded.