THE UNIVERSITY OF MANITOBA
COMP 1020: Introductory Computer Science 2
Term Test 2 (TT2)
A01 – Thursday, November 20, 2025

Student Information: Fill in one letter or number per box.

Academic Integrity Contract

I understand that cheating is a serious offence.

> *"As members of the University Community, Students have an obligation to act with academic integrity. Any Student who engages in Academic Misconduct in relation to a University Matter will be subject to discipline*." (2.4 - Student Academic Misconduct Procedure).

Student Signature:_____

Instructions – Please read carefully

1. Answer all questions on this paper ***in the spaces provided***. Answers must be on the same page as the question. Material on the cover page, a blank page, or on the wrong page, ***will not be marked***.
2. Answer questions using **Java programming language** and use **appropriate technical terms**.
3. Tests will be scanned for grading. **Write darkly**, and do not write very close to the edge of the paper, or in the **top** margin.
4. No aids ***of any kind*** (such as calculators, language translators, phones, smart watches, etc.) are permitted.
5. You have 60 minutes to complete the test.
6. There are 9 questions, and a total of 30 marks.
7. This test is worth 11% of your final grade in COMP 1020.
8. Fill in your identification information above. ***Do not*** write this information on any other page.

Part 1: Short Answer Questions (14 marks)

1. [3 pts total] For each of the following statements, indicate if the statement is True or False AND do the following.

- Correctly identify: **a True statement (1 mark), a False statement (0.5 marks).**
- **If the statement is False, indicate <u>why</u> (0.5 marks)**. You do not need to rewrite the entire statement; you can cross out words and replace them with the correct words or add words to the statement. <u>You do not earn any marks for simply negating the statement</u> (e.g., changing "This is a question." to "This is not a question.").

a) [1 pt] **`ArrayList<char> myList;`** is a valid declaration for an ArrayList.

b) [1 pt] Selection sort uses the divide and conquer technique.

c) [1 pt] Insertion sort is always faster than selection sort.

2. [1 pt] Other than the lack of comments, identify at least two programming standard violations in the code below.

```
int x = 10;
int y = 20;
int z = x + y;
if(x==15)
{
    System.out.println(z);
}
```

3. [2pt] What is the output of the code below?

```
public static void main2(String[] args) {
    ArrayList<Integer> list = new ArrayList<>();
    int numCount = 8;
    for (int i = -1; i <= numCount; i+=2) {
        list.add(i * 2);
    }
    for (int i = list.size() - 1; i >= 0; i-=2) {
        list.remove(i);
    }
    System.out.println(list);
}
```

4. [2 pts] Describe what the following code is doing and name the data structure it belongs to.

```
public Node someMethod(int number) {
     Node result = null;
     if(head != null){
         Node result = head;
         while(curr.value != number && curr != null){
             curr = curr.next;
         }
     }
     return curr;
 }
```

5. [2 pts total] Consider the following multidimensional integer array declaration:

```
int[][][] numbers = new int[3][2][3];
```

a) [0.5 pts] How many total int values can be stored in this array? _____

b) [1.5 pts] Draw the memory diagram/representation of the multidimensional array. Include stack, heap, array(s) as objects, reference arrows, and any default values.

6. [3 pts total] Answer the following two questions given to code below:

```
public class Main {
    public static void sort(int[] arr) {
        for (int i = 0; i < arr.length - 1; i++) {
            int j = i;
            for (int k = i + 1; k < arr.length; k++) {
                if (arr[k] > arr[j]) { j = k; }
            }
            int m = arr[j]; arr[j] = arr[i]; arr[i] = m;
        }
    }
}
```

a) [1 pt] Name the sorting algorithm used in the code.

b) [2 pts] Demonstrate how the algorithm works by providing a step-by-step walkthrough of sorting the array: [4, 7, 3, 6, 1].

Ensure that your diagram captures the state of the array at the end of each iteration of the outer for loop (i.e., each 'pass' of the algorithm).

7. [1 pt] Which of the following can happen if a recursive method does not have a base case? Circle or indicate all that apply:

A. The program may terminate due to a StackOverflowException

B. The method will return the wrong answer.

C. The method will not stop recursively calling itself.

D. The program may terminate due to an OutOfMemoryError

Part 2: Long Answer Questions (16 marks)

8. [8 pts total]

a) [5.5 pts] Write a recursive method count2s that takes an int n and returns the number of 2s in the number. Follow best programming standards including method declaration, variable naming, and handling invalid input.

Example:

Input: 1231232 Result: 3

Input: 22 Result: 2

Input: 354 Result: 0

b) [2.5 pts] Provide the input (parameters) to your method which will result in the method being called 3 times (total), including the first time with the original input (i.e., depth = 3). Show what the input and output is for each call. Call #3 should result in the base case being triggered.

Call #1 input: _____

Call #2 input: _____

Call #3 input: _____

Base Case Reached!

Output #3: _____

Output #2: _____

Output #1: _____ (final result)

9. [8 pts] Write a method that will be passed a 2D array of ints. Assume the array has already been filled with data elsewhere, before being passed to the method. The method should:

    1. Process the 2D array to replace any even values (but not 0) with -1, then
    2. Return an array of the total (new) sum of integer values in each column of the 2D array.

Assume:

- The array might not be square or rectangular.
- At least one row will contain an even value.

Example:

If the method is passed the array:

```
 1  2 -8  1
-3  0  3
 0  0 -5 -2  0  0
```

It should be processed to:

```
 1 -1 -1  1
 0  0  3
 0  0  0  0  0  0
```

It will return an array with the sum of each column in the resulting 2D array.

Blank Page for continued work or scrap notes.

If you are continuing work, clearly indicate which question is continued on this page and where.

Use this page for rough work only. It will NOT be graded.