CS-1004: Object Oriented Programming

PART III of III

(SE-A), (SE-B), (SE-C), (SE-D), (SE-E), (SE-F), (SE-G)

Serial No:

Final Exam

Total Time: 55 mins

Total Marks: 55

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Signature of Invigilator

Monday, 22nd May, 2023

Course Instructors

Mr. Bilal Khalid Dar, Ms. Maheen Arshad, Ms. Uzma Mahar

Student Name	Roll No.	Course Section	Student Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

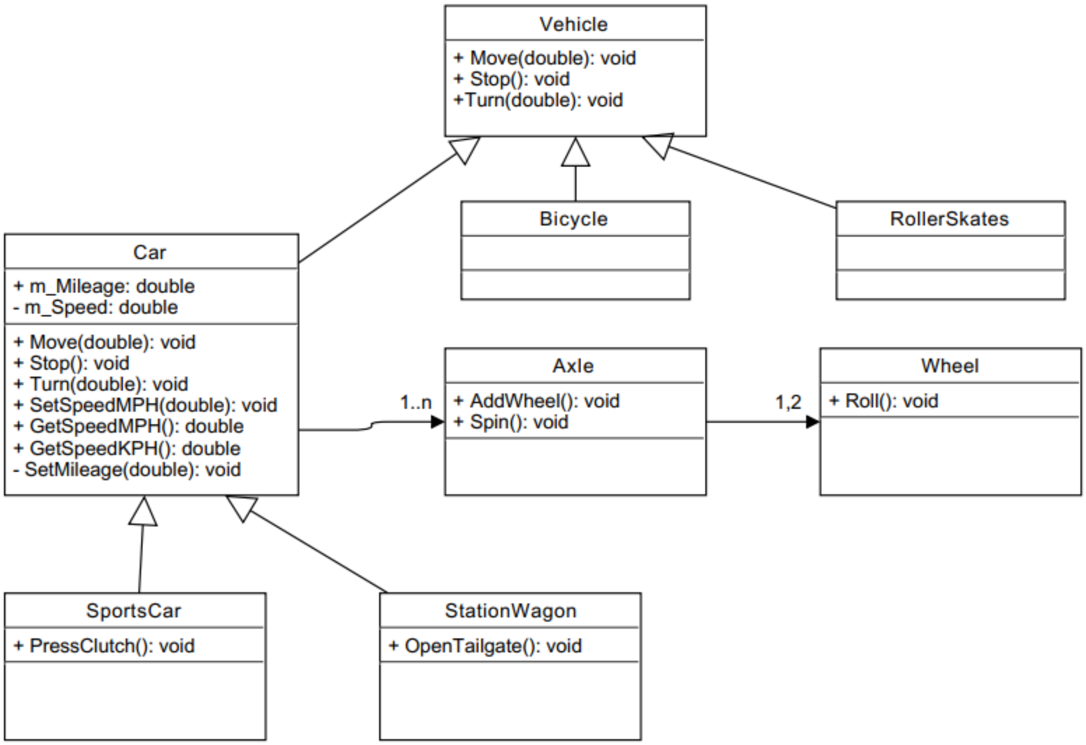
1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space, write on the back side of the paper and clearly mark question and part number etc.
4. After being asked to commence the exam, please verify that you have **NINE (9)** different printed pages including this title page. There are total of **06** questions.
5. All answers must be written in the provided space
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Total
Marks Obtained							
Total Marks	**08**	**07**	**10**	**10**	**10**	**10**	**55**

PART II

Question 1 [Total Marks = 8 Marks]

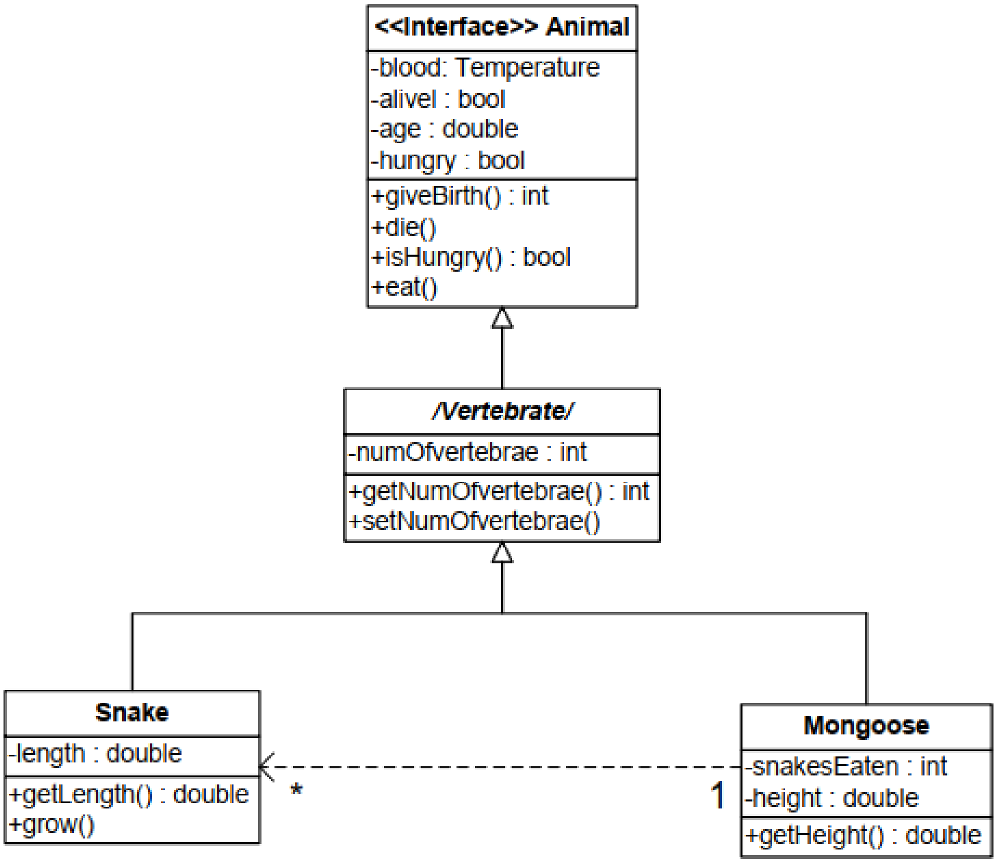
i. Consider the following class diagram: (4 marks)



1 mark each. Multiple answers and cutting resulted in zero marks

Statement	***Correct***	***Wrong***
The class Vehicle does not contain any attributes.	[✓ O]	O
The diagram contains a mistake: the direction of the five arrows with empty arrowheads pointing at Vehicle and Car should be reverse.	O	[✓ O]
The objects of class StationWagon do not have any attributes.	O	[✓ O]
SportsCar has a method called AddWheel().	O	[✓ O]

ii. Please fill in all the answers for the given class diagram (4 marks)



1 marks each. In correct relation answers has zero marks

What is the relationship between Vertebrate and Animal?

Answer:
Inheritance. Vertebrate is a subclass of Animal.

What is the relationship between Snake and Animal?

Answer:
Muti level Inheritance Snake is a subclass of Animal.

What is the association type between Mongoose and Snake?

Answer:
Dependency association.

According to the class diagram, can 2 mongooses eat 1 snake?

.
Answer:
No. The relationship between Mongoose and Snake is one-to-zero-or-more.

Question 2 [Total Marks =7 Marks]

Consider the following C++ code and answer the following questions.

```
#include <iostream>
#include <stdexcept>

using namespace std;

int magic_function(int n) {
    if (n < 0) {
        throw logic_error("Result cannot be generated for the negative 
numbers.");
    }

    if (n == 0 || n == 1) {
        return 1;
    }

    int result = 1;
    for (int i = 2; i <= n; i++) {
        result *= i;
    }

    return result;
}
int main() {
    int n;
    cout << "Enter a positive integer: ";
    cin >> n;

    try {
        int result = magic_function(n);
        cout << "Result of " << n << " is: " << result << endl;
    }
    catch (const exception& e) {
        cerr << "Error: " << e.what() << endl;
    }
    return 0;
} correct solution has marks else zero
```

1. What is the output of above code if n = 5 [2 marks]
120
2. What is the output of above code if n = 5 [2 marks]
120
3. What is the purpose of magic function? [3 marks]
Finding factorial

Question 3 [Total Marks = 10 Marks]

Write a generic function, Find, that receives an array arr, size of the array size, a search key key, and an integer parameter passed by reference location.

The function should perform linear search on arr looking for key, and place the location of the item (if found) in location. The function should return a bool value to indicate whether the item was found or not. You can assume all comparison and subscript operators have been properly overloaded.

Here is some sample code on how this function would be used. The function should generate an exception object if the size parameter is less than or equal to zero. The program should recover after handling an exception.
You can merely output an error message if an exception is thrown.

//Program main

```
int main() {
int x, index, numbers[5] = { 10, 20, 30, 45, 66 };
const char* names[5] = { "Bruce", "Clark", "Diana", "Dick", "Peter"};
cout << "Enter a number " ;
cin >> x;
if (Find(numbers, -4, x, index))
cout << "Found " << x << " at " << index << endl;
else
cout << "Item " << x << " not in array" << endl;
if (Find(names, 5, "Diana", index))
cout << "Found Diana at " << index << endl;
else
cout << "Item " << names << " not found" << endl;
return 0;
}
```

```
class InvalidArraySize {
public:
InvalidArraySize() : msg("error") { }
const char* what() { return msg; }
private:
const char* msg;
};
template <class T>
bool Find (T arr[], int size, T key, int& index)
{
try { if (size <= 0) throw InvalidArraySize(); }
catch (InvalidArraySize ex) {
cerr << ex.what() << endl;
}
for (int i = 0; i < size; i++)
if (arr[i] == key) {
index = i;
return true;
}
```

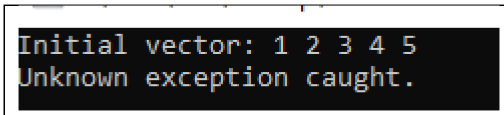
Function calls should be correct, should have a return type
Should return bool
Must have exception handling

Question 4 [Total Marks = 10 Marks]

What is the output of the following code

```
#include <iostream>
#include <vector>
#include <stdexcept>

using namespace std;

int main() {
    try {
        vector<int> numbers;
        numbers.push_back(1);
        numbers.push_back(2);
        numbers.push_back(3);
        numbers.push_back(4);
        numbers.push_back(5);

        cout << "Initial vector: ";
        for
(vector<int>::const_iterator  it  =
numbers.begin();        it        !=
numbers.end(); ++it) {
            cout << *it << " ";
        }
        cout << endl;

        int value = numbers.at(10);

numbers.push_back(1000000000000000
0000);

        cout  <<  "Modified  vector:
";
        for
(vector<int>::const_iterator  it  =
numbers.begin();        it        !=
numbers.end(); ++it) {
            cout << *it << " ";
        }
        cout << endl;
    }

    catch   (const   overflow_error&
ex) {
        cout   <<   "Overflow   error
exception caught: " << ex.what() <<
endl;
    }
    catch (...) {
        cout  <<  "Unknown  exception
caught." << endl;
    }

    return 0;
}
```

Output:



```
Initial vector: 1 2 3 4 5
Unknown exception caught.
```

In correct partial solution = 3 marks

Correct solution has 10 marks

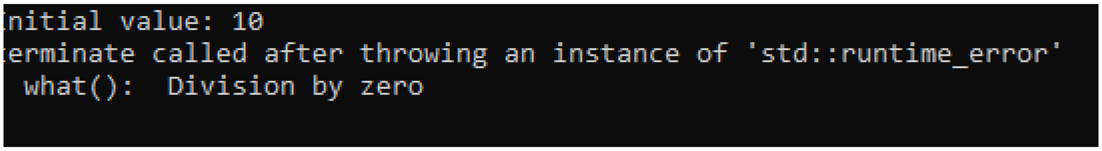
Question 5 [Total Marks = 10 Marks]

What is the output of the following code.

```
#include <iostream>
#include <stdexcept>
#include <string>

using namespace std;

class CustomException : public
exception {
public:
    const char* what() const
throw() {
        return "Custom exception:
Something went wrong!";
    }
};

int divideNumbers(int numerator,
int denominator) {
    if (denominator == 0) {
        throw
runtime_error("Division by zero");
    }
    return numerator / denominator;
}

int main() {
    try {
        int value = 10;
```

```
        cout << "Initial value: " <<
value << endl;

        // Arithmetic operations
        value += 5;
        value *= 2;
        value -= 15;

        // Division operation
        int result =
divideNumbers(value, 0);
        cout << "Division result: "
<< result << endl;

        // Custom exception
        if (result > 10) {
            throw
CustomException();
        }

        cout << "Final value: " <<
value << endl;
    }

    catch (const out_of_range& ex)
{
        cout << "Out of range
exception caught: " << ex.what() <<
endl;
```

Output:



```
nitial value: 10
erminate called after throwing an instance of 'std::runtime_error'
  what():  Division by zero
```

Correct solution = 10 marks

Question 6 [Total Marks = 10 Marks]

The following shows a standard C++ program that reads a list of integers, sort them and print them.

```
#include <stdlib.h>
#include <iostream.h>
// a and b point to integers. cmp
returns -1 if a is less than b,
// 0 if they are equal, and 1 if a
is greater than b.
inline int cmp (const void *a, const
void *b)
{
int aa = *(int *)a;
int bb = *(int *)b;
return (aa < bb) ? -1 : (aa > bb) ?
1 : 0;
}
// Read a list of integers from
stdin
// Sort (c library qsort)
```

```
// Print the list
int main (int argc, char *argv[])
{
const int size = 1000; // array of
1000 integers
int array [size];
int n = 0;
// read an integer into the n+1 th
element of array
while (cin >> array[n++]);
n--; // it got incremented once too
many times
qsort (array, n, sizeof(int), cmp);
for (int i = 0; i < n; i++)
cout << array[i] << "\n";
return 0;
}
```

Re-implement the above program using STL container, iterator, and algorithms. Assume all operators have been appropriated overloaded and/or provided for, and all appropriate header files have been included. Although there are ways other than using STL to implement this simple function, full credits will only be given for solutions that directly employ STL features to solve the problem.

```
Key 1:
#include <string.h>
#include <algo.h>
#include <vector.h>
#include <stdlib.h>
#include <iostream.h>
main ()
{
vector<int> v; // create an empty vector of integers
int input;
while (cin >> input) // while not end of file
v.push_back (input); // append to vector
sort(v.begin(), v.end());
int n = v.size();
for (int i = 0; i < n; i++)
cout << v[i] << "\n";
}
}
```

Vector is the right solution. Array is replaceable with vector, List is incorrect.

Key 2:

```
#include <string.h>
#include <algo.h>
#include <vector.h>
#include <stdlib.h>
#include <iostream.h>
main ()
{
vector<int> v;
istream_iterator<int,ptrdiff_t> start (cin);
istream_iterator<int,ptrdiff_t> end;
back_insert_iterator<vector<int> > dest (v);
// note: for the above, if ptrdiff_t is skipped, it is still right for
certain compilers.
// Iterators are sometimes parameterized on two types; the second is a
// distance type, which is really for compatibility on operating systems
// with multiple memory models.
copy (start, end, dest);
sort(v.begin(), v.end());
copy (v.begin(), v.end(), ostream_iterator<int>(cout, "\n"));
```