VNUHCM-UNIVESRITY OF SCICENCE

FINAL EXAMNINATION

Semester I – Academic year 2023-2024

ARCHIVE CODE
(written by ET&QA Office)

Course name:	**Object Oriented Programming**	**Course code:**	
Time:	**100 minutes**	Date:	

Note: *Students are allowed to use ONE HAND-WRITING A4 PAPER during the examination*

Full name of Student: ….....**Student ID:** ……..… **No**: …...

Question 1 (1 point)

Tell the three differences between virtual function and pure virtual function in C++.

Question 2 (2 points)

```
1:  #include <iostream>
2:
3:  struct Beverage {
4:    Beverage() { std::cout << "Make new beverage.\n"; }
5:    Beverage(const Beverage &b) { std::cout << "Copy beverage.\n"; }
6:  };
7:  struct Coffee: public Beverage {
8:    Coffee() { std::cout << "Make new coffee.\n"; }
9:    Coffee(const Coffee &c) { std::cout << "Copy coffee.\n"; }
10: };
11: struct Cappuchino: public Coffee {
12:   Cappuchino() { std::cout << "Make new cappuchino.\n"; }
13: };
14:
15: int main() {
16:   Cappuchino c1;
      Cappuchino c2(c1);
    }
```

a) What are printed to the screen when compiling and executing the above program?

b) Explain the order of execution of the program.

Question 3 (3 points)

Class **PrimeList** is used to generate and contain a list of prime numbers which are smaller than an upper bound integer. By using only raw pointer and memory allocation in C++, implement class **PrimeList** for the following main function to run correctly (without memory leak or semantic error):

```
int main() {
  PrimeList list1(100);   // Construct prime list to upper bound 100.
  std::cout << list1;     // Print all primes in list.
  list1.generate(500);    // Re-construct list to new upper bound 500.

  PrimeList list2;        // Construct empty list.
  list2 = list1;          // Copy list.
  std::cout << list2[list2.count() - 1]; // Print the last prime in list.
}
```

Question 4 (4 points)

A web crawler is a program which automatically crawl data from specific online sources. You are joining a project to write a web crawler for iPhone prices from a website in C++.

Given code fragment from the main function showing how to use the crawler:

```
// Code fragment from the main function...
const char *url = "mobiles.com/iphone";
Crawler *task = new Crawler(url);
std::vector<Mobile *> items = task->execute();

std::cout << "Crawled " << items.size() << " phones from " << url << "\n";

for (Mobile *mobile: items) {
  mobile->print();
  std::cout << "\n";
}
```

Sample output:

```
Crawled 4 phones from mobiles.com/iphone
iPhone 11 64GB - 8950000
iPhone 12 128GB - 12500000
iPhone 13 Pro Max 256 GB - 18990000
iPhone 14 Pro 512GB - 23790000
```

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You are asked to do the followings:

a) **Draw class diagram** to describe the classes in the code fragment. (1.5 points)

b) **Implement (write code)** class **Mobile** from the code fragment. (1 point)

c) **Design and draw class diagram (no code)** for the solution of supporting different types of currency formats when printing the output. (1 point)

Sample output with vi-VN format	Sample output with en-US format
Crawled 4 phones from mobiles.com/iphone iPhone 11 64GB - 8.950.000 đ iPhone 12 128GB - 12.500.000 đ iPhone 13 Pro Max 256 GB - 18.990.000 đ iPhone 14 Pro 512GB - 23.790.000 đ	Crawled 4 phones from mobiles.com/iphone iPhone 11 64GB - VND 8,950,000 iPhone 12 128GB - VND 12,500,000 iPhone 13 Pro Max 256 GB - VND 18,990,000 iPhone 14 Pro 512GB - VND 23,790,000

d) **Design and draw class diagram (no code)** for the solution of supporting different ways of layouts when printing the output. (0.5 point)

Sample output with simple layout and vi-VN format	Sample output with table layout and en-US format
Crawled 4 phones from mobiles.com/iphone iPhone 11 64GB - 8.950.000 đ iPhone 12 128GB - 12.500.000 đ iPhone 13 Pro Max 256 GB - 18.990.000 đ iPhone 14 Pro 512GB - 23.790.000 đ	Crawled 4 phones from mobiles.com/iphone |Name |Price | |---| |iPhone 11 64GB |VND 8,950,000 | |iPhone 12 128GB |VND 12,500,000| |iPhone 13 Pro Max 256 GB |VND 18,990,000| |iPhone 14 Pro 512GB |VND 23,790,000|

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