Quiz #1

[CS 225] Advanced C/C++

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Name	Student login	Date	Points

Notes: This is a short-answer, closed books quiz. Do not collaborate or copy other people's work. Please write legibly – I can give points only for correct, clear answers I am able to read.

1. Analyse the class hierarchy

Given the following code that represents a class hierarchy, for each question below provide a valid answer, or write **NC** if the statement does not compile (then ignore it for the rest of the program).

```
1  #include <iostream>
2  struct IObject
3  {
4        unsigned short int cost() const { return 0; }
5  };
6  struct PowerUp : IObject
7  {
8        PowerUp(unsigned short int v) : cost{v} {}
9        PowerUp() : cost{0} {}
10       virtual ~PowerUp() = default;
11 protected:
12       unsigned short int cost;
13 };
14 struct HealthBonus : virtual PowerUp
15 {
16 public:
17       HealthBonus() : PowerUp(1) {}
18 };
19 class ManaBonus : virtual PowerUp
20 {
21 public:
22       ManaBonus() : PowerUp(2) {}
23       unsigned short int cost() const { return PowerUp::cost; }
24 };
25 struct SpecialItem :
26  public HealthBonus,
27  public ManaBonus
28 {
29       SpecialItem() : _owner{new PowerUp} {}
30       ~SpecialItem() { delete _owner; }
31 private:
32       IObject* _owner;
33 };
34 int main()
35 {
36       IObject* item = new SpecialItem;
37       std::cout <<  item->cost();
38       delete item;
39 }
```

a) What is the output text printed by the program? 0 ✓

b) What is the result of an expression: `sizeof(IObject)` ? 2 byte ✗ 1

c) What is the result of an expression: `sizeof(PowerUp)` ? 16 byte ✓

d) What is the result of an expression: `sizeof(HealthBonus)` ? 16 byte ✗ 24

e) What is the result of an expression: `sizeof(ManaBonus)` ? 16 byte ✗ 24

f) What is the result of an expression: `sizeof(SpecialItem)` ? ~~32~~ 24 byte ✗ 40

g) In the above fragment of the code (line 2) is the struct `IObject` **an interface class**? Explain.

No. line 4 is not a virtual function and an interface class must consist of virtual functions.

h) In the above fragment of the code (line 30) is the destructor `~SpecialItem()` a virtual member function? Explain.

Yes. SpecialItem inherits from HealthBonus and manaBonus which ~~are inherited by~~ a inherits a virtual PowerUp (base) class which consist of a virtual destructor, therefore the ~~derived~~ destructor of a derived class will automatically be a virtual ~~func~~ destructor member function too.

i) In the above fragment of code (line 32) there is a data member `_owner`: a pointer to an empty class; how does it increase the size of the `SpecialItem` class' instances? Explain.

data member _owner of type IObject* is composed by the specialItem class and when it is being composed (an empty class), it increases the size of the derive class by 1 byte ~~instead of when~~.

It is a pointer.

j) Suppose that this program compiles (in case it does not, ignore the errors and assume it does); does it experience memory leaks? Explain.

~~the~~. Yes. Struct IObject ~~do~~ does not have a virtual destructor and when it is being destroyed only the base class will be destroyed and will experience ~~member~~ memory leak from the derived classes.

2 leaks

End of quiz.