CS 300 Data Structures
Problem Set #3 Constructor and Destructors
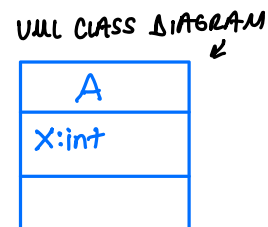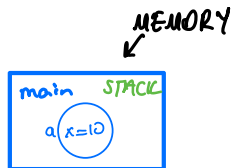
1. Like constructors, can there be more than one destructor in a class?

    NO

2. What is the output of the following program?

```cpp
#include <iostream>

using namespace std;

class A{
    private:
        int x;
    public:
        A(int _x){
            x = _x;
            cout<<"constructor... "<<x<<endl;
        }
        ~A(){
            cout<<"destructor... "<<x<<endl;
        }
};
int main(){
    A a(10);
    return 0;
}
```

MEMORY

main   STACK

a(x=10)

UML CLASS DIAGRAM

A
X:int

OUTPUT

constructor... 10
destructor... 10

3. What is the output of the following program?

```cpp
#include <iostream>
using namespace std;
class A{
   private:
         int x;
   public:
         A(int _x){
             x = _x;
             cout<<"constructor... "<<x<<endl;
         }
         ~A(){
             cout<<"destructor... "<<x<<endl;
         }
};
int main(){
   A a1(10);
   A a2(20);
   return 0;
}
```
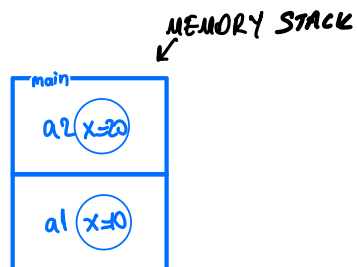
MEMORY STACK

main

a2 (x=20)

a1 (x=10)

OUTPUT

constructor... 10
constructor... 20
destructor... 20
destructor. .10

4. What is the output of the following program?

```cpp
#include <iostream>

using namespace std;

class A{
    private:
        int x;
    public:
        A(int _x){
            x = _x;
            cout<<"constructor... "<<x<<endl;
        }
        ~A(){
            cout<<"destructor... "<<x<<endl;
        }
};
int main(){
    A a1(10);
    A a2(20);
    A *a3 = new A(100);
    return 0;
}
```
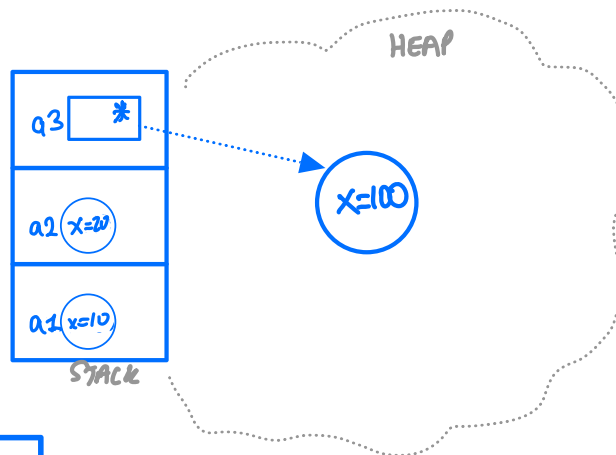
HEAP

a3 [*] ----> X=100

a2 (X=20)

a1 (X=10)

STACK

OUTPUT

Constructor...10
Constructor...20
Constructor...100
destructor...20
destructor...10
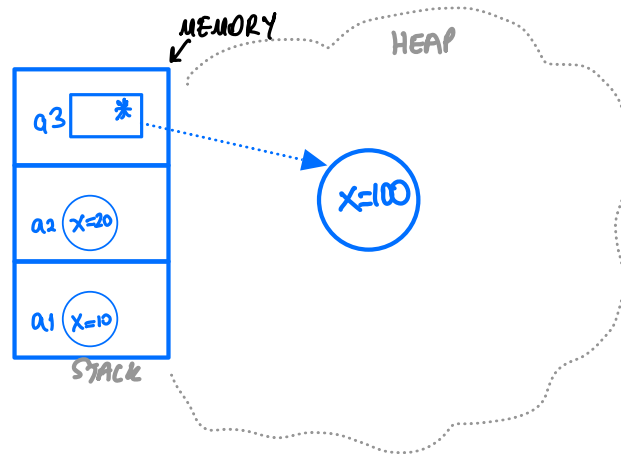
5. What is the output of the following program?

```
#include <iostream>

using namespace std;

class A{
    private:
        int x;
    public:
        A(int _x){
            x = _x;
            cout<<"constructor... "<<x<<endl;
        }
        ~A(){
            cout<<"destructor... "<<x<<endl;
        }
};
int main(){
    A a1(10);
    A a2(20);
    A *a3 = new A(100);
    delete a3;
    return 0;
}
```
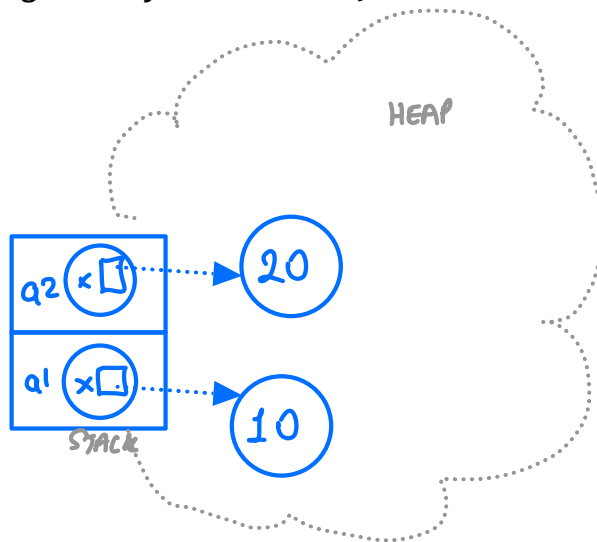
MEMORY

HEAP

a3 [*]

x=100

a2 (x=20)

a1 (x=10)

STACK

OUTPUT

Constructor...10
Constructor...20
constructor...100
destructor...100
destructor...20
destructor...10

6. What is the output of the following C++ program?

```cpp
#include <iostream>
using namespace std;
class A{
    private:
        int *x;
    public:
        A(int _x){
            x = new int(_x);
            cout<<"allocating memory"<<endl;
        }
        ~A(){
            cout<<"freeing memory... "<<endl;
            delete x;
        }
};
int main(){
    A a1(10);
    A a2(20);
    return 0;
}
```

HEAP

a2 [x] ·····▶ 20

a1 (x☐) ·····▶ 10

STACK

OUTPUT

allocating memory
allocating memory
freeing memory
freeing memory

7. What is the output of the following C++ program?

```cpp
#include <iostream>
using namespace std;
class A
{
    int id;
    static int count;
    public:
        A() {
            count++;
            id = count;
            cout << "constructor for id " << id << endl;
        }
        ~A() {
            cout << "destructor for id " << id << endl;
        }
};

int A::count = 0;

int main() {
    A a[3];
    return 0;
}
```

OUTPUT

Constructor for id 1
Constructor for id 2
Constructor for id 3
destructor for id 3
"   " 2
"   " 1

STATIC
GLOBAL — count = 0̷ 1̷ 2̷ 3

STACK

a[2] (id=3)
a[1] (id=2)
a[0] (id=1)

STACK