C++ Programming

Abstraction Homework

Mostafa S. Ibrahim
Teaching, Training and Coaching since more than a decade!

Artificial Intelligence & Computer Vision Researcher
PhD from Simon Fraser University - Canada
Bachelor / Msc from Cairo University - Egypt
Ex-(Software Engineer / ICPC World Finalist)

Homework 1: Analogy for 3 concepts

- Explain Encapsulation, Data Hiding and Abstraction in terms of your house components (analogy)
- Keywords:
  - Bed room, Store room, Kitchen, Bath room
  - Bed, Sofa, TA, fridge, fan, stove, shampoo
  - Valuables (money, jewelry)
  - How works (TV, fridge, fan) … do you care?

Homework 2: Context

- Recall: Abstraction is about **hiding** unwanted **details** while showing most essential in a given context
- Context helps us define what is really **relevant**
- Let’s say our department has 3 separate projects
  - Kindergarten Application, College School Application, College’s gym Application
  - Each application has its own Student class
  - Think in a few common data-members for each case for its own student class
  - Think in 1 unique feature for each case

Homework 3: Building

- We need to design a **Building** which consists of **Apartments** and **Elevators**
- Each **apartment** consists of **Rooms** and **Bathroom**
- Design set of classes to express the above customer requirements
  - Think in some suitable data members for the classes
  - Provide Setters and Getters

Homework 4: Invoice

- Several applications involve an invoice (Hotel, Online Shopping, etc)
- Design an invoice class that has the following fields
  - Name, item_number, price, quantity
  - E.g. Acer Laptop, 1011234, 3250.75, 2
- Support setters and getters for them
- Provide 3 other functionalities
  - GetTotalPrice, Print, ToString
  - ToString: Return a string for them **comma separated**
- Implement them in 1 file, but **separate** Declarations from Definitions
  - Optional: Separate using a header file also

Homework 5: Guess the output?

```
class MyClass {
private:
    int x;
    int y;
    int z;

public:
    void set(int x) {cout<<"A\n";}
    void set(double x) {cout<<"B\n";}
    void set(int x, int y) {cout<<"C\n";}
    void set(int x, int y, int z) {cout<<"D\n";}
    void get(int &a) {a = x; cout<<"E\n";}
    void get(int &a, int &b) {a = x, b = y; cout<<"F\n";}
};

int main() {
    MyClass m;
    m.set(1);
    m.set(1.5);
    m.set(1, 2);
    m.set(1, 2, 3);

    return 0;
}
```

- What is the output?
- What is the name of this feature?

Homework 6: Address

- We know every variable has a different address in memory
- What about a member function.
- If you have class LuckyNum and member function PrintAddress
  - You can print its address using:
  - printf("Function address :%p\n", &LuckyNum::PrintAddress);
    - Printf in c close to cout in C++
    - It is easier to use it to print the member function address
- Write a simple code to show:
  - Will every member function has its own address or common one?

"Acquire knowledge and impart it to the people."

"Seek knowledge from the Cradle to the Grave."