Synthesized Member Functions Solutions

Synthesized default constructor

- What is a default constructor?
  - The default constructor is a constructor which takes no arguments
- In what circumstances does the compiler synthesize a default constructor?
  - The compiler will synthesize a default constructor for a class which does not define any constructors (including a copy constructor)
- What does this synthesized default constructor do?
  - It default initializes all the members of the class
  - For class members, it calls their default constructor
  - For members of built-in type, it leaves them uninitialized

Synthesized copy constructor

- In what circumstances does the compiler synthesize a copy constructor?
  - The compiler will synthesize a copy constructor for a class which does not define a copy constructor itself
- What does this synthesized copy constructor do?
  - It copies each member of the class from the corresponding member in the argument object
  - For class members, it calls their copy constructor
  - For members of built-in type, it copies them

Synthesized copy constructor

- In what circumstances does the compiler synthesize an assignment operator?
  - The compiler will synthesize an assignment operator for a class which does not define an assignment operator itself
- What does this synthesized assignment operator do?
  - It assigns each member of the class to the corresponding member in the argument object
  - For class members, it calls their assignment operator
  - For members of built-in type, it assigns them

Drawbacks of synthesized functions

- Give some examples of when allowing the compiler to synthesize special member functions can have undesirable results
  - Default constructor causes default initialization of members of built-in type
  - Copy constructor and assignment operator cause pointer members to be "shallow copied"
  - Non-virtual destructor prevents derived class objects from being properly destroyed

Drawbacks of synthesized functions

- Suggest how to avoid these issues
  - Implement a default constructor which initializes the members with sensible values
  - Implement a copy constructor and an assignment operator which perform a "deep copy" of the pointer member
  - Implement an empty destructor in the base class and declare it virtual

Rule of Three

- What is the "Rule of Three"?
  - The Rule of Three states that, if any one of destructor, copy constructor or assignment operator has to be implemented for a class to work properly, all three should be implemented
  - This does not apply to a virtual destructor in a base class which is only there to prevent derived classes being "sliced"
- Give an example where the Rule of Three would be helpful
  - Class with pointer member which allocates memory in the constructor
  - This needs a destructor which releases the allocated memory, also a copy constructor and assignment operator to perform a "deep copy"
  - Here, the Rule of Three helps us avoid memory leaks and program crashes

Synthesized Special Member Functions

- Write a program which demonstrates the use of synthesized special member functions
- Add comments to your program showing the code that the compiler would generate when synthesizing these member functions