Program Design
Final Test

6/18/2019

I. Matching (15 %)

____1. Inheritance ____2. virtual function
____3. pure virtual function ____4. "Is a" relationship
____5. Base class ____6. abstract base class
____7. Indirect base class ____8. Base-class initializer
____9. Multiple inheritance ____10. dynamic binding
____11. Single inheritance ____12. polymorphism
____13. Derived class ____14. "Has a" relationship
____15. override a virtual function

a. Passes arguments to the base-class constructor.
b. Base class that is not listed explicitly in the derived class's definition.
c. Allows objects of different classes related by inheritance to respond differently to the same message.
d. Composition.
e. Deriving from only one base class.
f. New classes are created from existing classes.
g. Class that is defined, but never intended to be used by the programmer to create objects.
h. Class that is created by inheriting from an existing class.
i. Programming "in the general."
j. Occurs only off pointer or reference handles.
k. Inheritance.
l. Function prototypes that end with "= 0."
m. Class from which others are derived.
n. Deriving from more than one base class.
o. Process of replacing an inherited base-class member function with a derived-class one.

II. Closing (10 %)

a. The ______operator is used to dynamically allocate memory and construct an object; this operator returns a pointer to the object.
b. The ______operator is used to destroy an object and release dynamically allocated memory.
c. A self- ______ structure is used to form dynamic data structures that can grow and shrink at execution time.
d. The pointer to the next node in a linked list is referred to as a(n) ______.
e. A(n) ______ is a nonlinear, two-dimensional data structure that contains nodes with two or more links.
f. The nodes of a(n) ______ tree contain two link members.
g. A tree node that has no children is called a(n) ______ node.
h. There are three common ______, ______, and ______ traversal algorithms for binary search trees.

III. In traditional C, a node of a linked list is defined as a structure: (35 %:a10,b10,c10,d5)

```
struct listNode {     /* self-referential structure */
    int data;
    struct listNode *nextPtr;
};
```

a. Please define in C++ a class **ListNode** that has two ***private*** data members corresponding to the above structure. Please also define a constructor for the class **ListNode** and the gets and sets member functions for the data members. (Interface only, no implementation)

b. Please define in C++ the interface of a class **List** that has only a data member **startPtr** that points to the first node of a list of **ListNode** in a. The class also has a constructor, a destructor, and the following member functions for operating a list create by **List** class.

```
bool insertAtFront(int value);
bool insertAtBack(int value);
bool removeFromFront(int *value );
bool removeFromBack(int *value );
ListNode *getNewNode(int value );
```

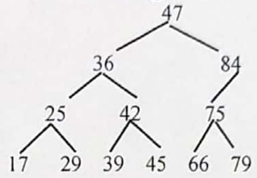
c. Please define in C++ a derived class **ListGen** that inherits from class **List.** It has no data member but the following member functions.

```
ListGen();
void insertinorder( int );
int deletefound( int );
```

d. What should you declare in class **ListNode** to make class **List** and class **ListGen** able to access its private data members?

IV. The definition of class **Queue** (FIFO) with ***enqueue*** and ***dequeue*** member function and class **Stack** (FILO) with ***push*** and ***pop*** member functions based on the **List** definition can be done by using *inheritance*. Please give these **two** definitions respectively. (10%:5 each)

V. A **binary search trees** containing **integers** is built as in the figures below. (Total 15%)

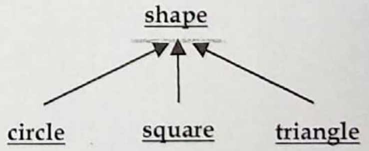


a. Please manually **insert** the following new node **15, 27, 38, 49, 58, 69, 80, 89, 96** into the binary search tree. Draw the entire final binary search tree. *(5 %)*

b. Please manually travers the binary search tree by **inorder**, **preorder**, and **postorder**. (Write out the sequence of numbers visited) *(5 %)*

c. Please define the structure **treeNode** and a function **insertNode** that can insert a new node into a **binary search tree**. *(5%)*

VI. A shape hierarchi is as follows: (15%:a5,b10)



a. Define (without implementation) the Shape classes hierarchy. The abstract class **shape** and each two dimensional shape derived classes should have a method **CalculateArea()** to calculate the area of the shape. Define all the classes so that they can demonstrate polymorphism when calling the **CalculateArea()** method.

b. Create a program segment that uses a vector of **shape** pointers to objects of each derived class in the hierarchy. Create the objects of a circle, a square, and a triangle and put them into the vector. Then create a loop to print out the areas of all the shape objects in the vector by calling their **CalculateArea()** method.

董事長的助理叫光光, 有天董事長叫助理去買了蛋塔，然後親自拿去分給每位員工享用, 一位女性主管吃到，驚覺非常好吃, 董事長說：這是我託光光去買的，如果喜歡的話，妳也可以託光光去買, 女主管面有難色問…一定要脫光光嗎？ 董事長說：不託光光也可以，只是託光光去買比較快，不然等下我託光光帶妳去～

美好的一天，祝考試愉快～

Scanned by CamScanner