


**1. Pointers and Dynamic Arrays in C++**

(a) What are the outputs produced by the following C++ codes? (5%)

```
int *p1, *p2; p1 = new double; p2 = new double;
*p1 = 1.1; *p2 = 2.2; cout << "p1, p2 = " << *p1 << ", " << *p2 << endl;
p1 = p2; cout << "p1, p2 = " << *p1 << ", " << *p2 << endl;
*p1 = 3.3; cout << "p1, p2 = " << *p1 << ", " << *p2 << endl;
*p1 = 1.1; *p2 = 2.2; cout << "p1, p2 = " << *p1 << ", " << *p2 << endl;
*p1 = 3.3; cout << "p1, p2 = " << *p1 << ", " << *p2 << endl;
```

(b) What is the output of the following C++ codes? (5%)

```
int ArraySize = 10; int *p; p = new int [ArraySize]; int *a = p; int i;
for (i = 0; i < ArraySize; i++) p[i] = i * i; a[0] = 10;
for (i = 0; i < ArraySize; i++) cout << p[i] << " "; cout << endl;
```

**2. Structures and Classes in C++**

 (a) Write a definition for a structure type in C++ for records consisting of a person's wage rate (denoted by *double* wage\_rate), vacation (number of days, denoted by *int* vation), and status (hourly (H) or salaried (S), denoted by *char* status). Denote this structure type as EmployeeRecord. (5%)

 (b) Consider the following *class* definition in C++:

```
class YourClass
{ Public:   YourClass(int a, char b);
           YourClass();
           void fun();
  private: int aa;
           char bb; };

```

Which of the following statements in C++ are legal? (5%)

- (1) YourClass object1(40, 'B');
- (2) YourClass object2;
- (3) object1 = YourClass(41, 'C');
- (4) object1 = YourClass;
- (5) object1 = YourClass();

**3. Friends and Constructors in C++ Classes**

 (a) What is the difference between a *friend* function for a class and a member function for the class? (5%)

 (b) Consider the following statement which is the first line of the copy constructor definition for the class **StringVar**. The identifier **StringVar** occurs 3 times and means something slightly different each time. What does it mean in each of the 3 cases? (5%)

```
StringVar::StringVar(const StringVar& string_object)
```

4. Please describe the algorithm or write C++ codes for the Selection Sort. (10%)

5. Please write: (1) a C++ class declaration for a Binary Search Tree (5%); and (2) the implementation of a member function of the class, called BinarySearch, which can perform binary search in a recursive manner. (5%)

6. Consider a direct-mapped cache with 64 blocks and a block size of 16 bytes. To what block number does byte address 1202 map? (10 %)



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7. Find the AMAT (Average Memory Access Time) for a processors with a 1 ns clock cycle time, a miss penalty of 40 clock cycles, a miss rate of 0.05 misses per instruction, and a cache access time (including hit detection) of 1 clock cycle. Assume that the read and write miss penalties are the same and ignore other write stalls. (10%)
8. Suppose you want to achieve a speed-up of 80 times faster with 100 processors. What percentage of the original computation can be sequential? (10%)

以下為單選題

9. (5%) A page fault
  - A. is an access to a page not currently in memory
  - B. occurs when a program accesses a page of memory
  - C. is a reference to a page belonging to another program
  - D. is an error in a specific page
  - E. is a system bus error
10. (5%) Which of the following is not true about the memory management?
  - A. segmented memory can be paged
  - B. segmentation suffers from external fragmentation
  - C. virtual memory is used only in multi-user systems
  - D. paging suffers from internal fragmentation
  - E. the main memory must accommodate both the operating system and the various user processes
11. (5%) Paging
  - A. consists of those addresses that may be generated by a processor during execution of a computation
  - B. is a method of memory allocation by which the program is subdivided into equal portions, or pages and core is subdivided into equal portions or blocks.
  - C. is a method of allocating processor time
  - D. allows multiple programs to reside in separate areas of core at the time.
  - E. is used to communicate across with a CPU
12. (5%) Under virtual storage,
  - A. two or more programs are stored concurrently in primary storage
  - B. a single program is processed by two or more CPUs
  - C. interprogram interference may occur
  - D. only the active pages of a program are stored in primary storage
  - E. disks can be removed without affecting system performance