



Please print clearly :

Name :

Login :

@ucsc.edu

Code only in C++11. No books ; No calculator ; No computer ; No email ; No internet ; No notes ; No phone. Neatness counts ! Do your scratch work elsewhere and enter only your final answer into the spaces provided.

1. Write a complete program. Print the message “**Hello, World!**” to **cout** if no command line arguments are given, and return an exit status of 0. If arguments are given, print the message “**Usage: hello**” to **cerr**, and return an exit status of 1. **[2✓]**
2. Show what should be in the header file **queue.h**. The elements of the queue are **strings**. The representation of the queue uses the STL data structure **deque**. The operations available to the user of a queue are **push_back**, **pop_front**, **front**, and **empty**. Also, **operator<<** is a friend. Types and references are to be consistent with the STL standards. **[3✓]**
3. Define **operator<<** as mentioned above so that it prints out a queue with the elements in sequence from front to back with a single space between elements, but no space in front of the first or after the last element. **[2✓]**
4. Assuming the **bigint** project dealt only with unsigned numbers, but using the same representation, finish coding the following function. **[3✓]**

```
using bigint = vector<unsigned char>;  
ostream& operator<< (ostream& out, const bigint& big) {
```

5. Write the function **filter**. It takes a pair of iterators into a vector and a predicate which determines which of the elements are good. It pushes all good elements onto the back of a list in the same order they appear in the vector. Ungood elements are ignored. [2✓]

```
using iter = vector<string>::const_iterator;
using isgood = bool (*) (const string&);
list<string> filter (iter begin, iter end, isgood p) {
```

6. Inheritance.

- (a) Define a class **base** with an abstract virtual function called **value** that returns a **size_t**. [1✓]
- (b) Define a class **zero**, derived from **base**, which overrides that virtual function, so that it always returns the value 0. [1✓]
- (c) Define a class **str**, derived from **base**, with a private string field and whose **value** function returns the **size** of the string. Do not show any members except those explicitly mentioned here. [2✓]

7. Define the function **reverse** which reverses elements in a linear data structure. Assume the template argument **Iter** is a bidirectional iterator, i.e., one for which both **operator++** and **operator--** are provided. [2✓]

```
template <typename Iter>
void reverse (Iter begin, Iter end) {
```

8. Define the function **canonicalize** which takes a vector of digits, as in the assignment, and removes all high-order zeros. If all digits are zeros, the vector should be emptied. [2✓]

```
using bigint = vector<unsigned char>;
void canonicalize (bigint& big) {
```

Multiple choice. To the *left* of each question, write the letter that indicates your answer. Write **Z** if you don't want to risk a wrong answer. Wrong answers are worth negative points. **[12✓]**

number of correct answers		$\times 1 =$	$= a$
number of wrong answers		$\times \frac{1}{2} =$	$= b$
number of missing answers		$\times 0 =$	0
column total $c = \max(a - b, 0)$	12		$= c$

- Which of the following programming errors will definitely crash a program ?
 (A) allowing memory leak
 (B) an out-of-bounds subscript to a vector
 (C) dereferencing a null pointer
 (D) using uninitialized variables
- Given `string s;` `string t;` which will compare two strings lexicographically ?
 (A) `&s < &t`
 (B) `*s < *t`
 (C) `s < t`
 (D) `strcmp (s, t) < 0`
- What is used to initialize a vector from the command line arguments, but not the program name ?
 (A) `vector<string>`
 `vs (&argv[0], argv[argc - 1]);`
 (B) `vector<string>`
 `vs (&argv[0], argv[argc]);`
 (C) `vector<string>`
 `vs (&argv[1], argv[argc - 1]);`
 (D) `vector<string>`
 `vs (&argv[1], argv[argc]);`
- What will define `vs` as a typename meaning the same as `vector<string>` ?
 (A) `typedef vector<string> = vs;`
 (B) `typedef vs = vector<string>;`
 (C) `using vector<string> = vs;`
 (D) `using vs = vector<string>;`
- In order to avoid explicitly qualifying library entities, what statement should follow the usual includes ?
 (A) `import namespace standard;`
 (B) `include namespace std;`
 (C) `using namespace standard;`
 (D) `using namespace std;`
- After the declaration `int& p = i;` which statement will change the value of `i` ?
 (A) `&p = i;`
 (B) `*p = i;`
 (C) `p = &i;`
 (D) `p = i;`
- What is the preferred way to refer to a pointer that does not point at any object ?
 (A) 0
 (B) `NULL`
 (C) `null`
 (D) `nullptr`
- Which of the following STL classes manages memory via reference counting ?
 (A) `auto_ptr`
 (B) `shared_ptr`
 (C) `smart_ptr`
 (D) `unique_ptr`
- Which of the following forms of polymorphism should be used in C++ to replace `union` in C ?
 (A) conversion
 (B) inheritance
 (C) overloading
 (D) templates
- Which of the following operators can almost never be a member function ?
 (A) `operator++`
 (B) `operator->`
 (C) `operator<<`
 (D) `operator==`
- Which of the following containers has the least heap space overhead ?
 (A) `deque`
 (B) `list`
 (C) `map`
 (D) `vector`
- Which data structure is most likely as an implementation of the STL `map` ?
 (A) array of pointers
 (B) double-ended queue
 (C) hash table
 (D) red-black tree