Question # 1 [**10 marks**] Recent implementations of C++ compilers refuse to compile the following code :

```
class Foo {
  .....
  Foo(Foo f) {
    ....
  }
}
```

Why? *Older versions actually did compile this with disastrous results.* **Hint:** *Feel free to answer in one sentence.*

Question # 2 [**10 marks**] All variables and methods of a class inherit to its derived classes, including those that are private (*even if they are inaccessible directly*).

Write a very short (*5-10 line*) code segment with two classes – `Base and Derived` – which demonstrates that private instance variables of `Base` are present in `Derived`.

Question # 3 [**10 marks**] In a few words (*if you wish in point form*) describe what polymorphism is and describe a small application (*maybe with a tiny object model*) where its use benefits the programmer.

Question # 4 [10 marks] Parametric classes. (Container & Iterator)

4.1. [**3 marks**] Why do container classes usually contain pointers to instances rather than the instances themselves?

4.2. [**3 marks**] What is the main reason (*in your opinion*) to implement container classes using templates?

4.3. [**4 marks**] What use – other than implementing container classes and iterators – do you think are there for templates ? (*Be very brief!*)

Question # 5 [10 marks] Pointers & Arrays

5.1. [**4 marks**] Allocate a 2x3 matrix dynamically and save its address in a variable:
`int **a;`

5.2. [**3 marks**] Draw how it would look in physical memory (*that is, graphically indicate ONE possible arrangement of the rows and columns, observe adjacencies and do separate those blocks of memory that may not be contiguous.*)

5.3. [**3 marks**] On your diagram, indicate what

- `a`
- `*a[1]`
- `&a[0][2]`
- `a[0]`

are. *Feel free to use the next page as well to answer this question.*

Continued for question 5

Question # 6 [10 marks] Question about the "project".

Suppose you are asked to describe your involvement/contribution of the C++ project you had in 1998. (*The scripted drawing package.*)

6.1. [**4 marks**] In a very few words – if you wish in point form – summarize your work! *Be very brief and spare any technical jargon! You are limited to space between this and the next question!*

6.2. [**6 marks**] In a very few words, discuss how your design of the project can be extended

- to support more shapes (*pentagon, ….*)
- to support more options (*line width, …*)

also comment on how much work you predict these changes would take. *Be very brief and down to the point. Absolutely* **no** *code required!*

Question # 7 [10 marks] List all situations (*you know*) where

1. The default constructor is called
2. A particular constructor is called implicitly
3. The copy constructor is called
4. The destructor is called

No code examples are needed!

Question # 8 [10 marks] Streams.

8.1. [**5 marks**] What is serialization?

8.2. [**5 marks**] A programmer is faced with the problem to read `foo` objects from a modem. She has already obtained an implementation of `istream& operator>>(istream&,foo&)`. What does she have to do? **Hint:** *there is only one meaningful answer!*

1. modify `istream& operator>>(istream&,foo&)`
2. implement `ostream& operator<<(ostream&,const foo&)`
3. implement the subclass `imodemstream: public istream`
4. implement the subclass `omodemstream: public ostream`
5. panic

Question # 9 [**10 marks**] **True or false?** If the answer is "True" just write so, if the answer is "False" give a word or so explanation why it is false.

9.1. [**2 marks**] Constructors inherit.

9.2. [**2 marks**] The destructor inherits.

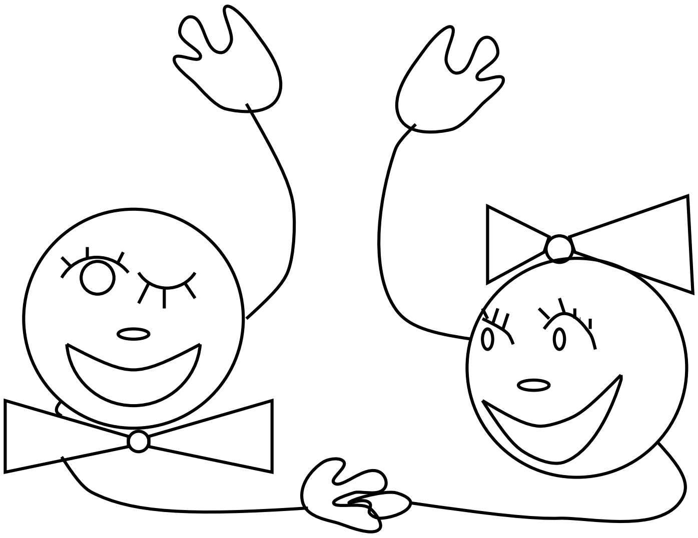
9.3. [**2 marks**] The assignment operator inherits.

9.4. [**2 marks**] A static variable of a class has the same physical address for all instances of the class.

9.5. [**2 marks**] `C`'s `malloc` and `free` can be used instead of `C++`'s `new` and `delete` operators with **no** side effects.

Question # 10 [**10 marks**] Very briefly describe an application which demonstrates how inheritance facilitates code reuse. (*A small object model may accompany your description. Absolutely no code required!*)

Good Luck !



CSI 2172A Final Examination

April 17, 1998

Name: ______________________________

Student Number: ______________________________

- This is a 3 hours long examination.
- This is a *closed book* examination.
- Answer all questions in the space provided and use the back of the pages if it is necessary.
- This examination booklet contains **14** numbered pages including this cover page.

Question	Page	Maximum	Your Mark
1.	2	10	
2.	3	10	
3.	4	10	
4.	5	10	
5.	6	10	
6.	8	10	
7.	10	10	
8.	11	10	
9.	12	10	
10.	13	10	
Total: