



[**May use one side of an 8.5 × 11 inch sheet of paper**] Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, clearly identify to which exam question it is related. Be sure to **read each problem carefully**. You should answer all 3 questions, and you may wish to answer the bonus question if you have time. Note that the exam is double sided.

1. (15 points) Briefly, in your own words, describe the difference between passing by reference and passing by value. Give an example of when it makes sense to use each (be sure to explain your examples).

2. This is a multi-part question that makes use of the following class:

```
class album {
2
3 public:
4     album();
5     ~album();
6     bool add(const MP3& track, const string& filename);
7     bool play(unsigned int index) const;
8     bool playAll() const;
9     bool playRandom() const;
10    string getAlbum() const;
11    string getArtist(unsigned int index) const;
12    string getFilename(unsigned int index) const;
13    double getLength(unsigned int index) const;
14    string getTitle(unsigned int index) const;
15    int getYear() const;
16    void display() const;
17 private:
18
19
20
21
22 };
23
24 ostream& operator<<(ostream& ostr, const album& alb);
```

(a) (10 points) Add the appropriate data members to the class so that the functionality described in the lab 2 handout can be implemented.

(b) (20 points) Implement the `display()` member function so that it sends information representing the `.tag` file to the output stream. Recall that the tag file should have the following format:

```
TITLE=Disk 2
YEAR=1996
FILENAME1=2.mp3
FILENAME2=3.mp3
FILENAME3=4.mp3
TRACK1=Two Minute Warning
TRACK2=Three Stooges
TRACK3=The Four Spiritual Laws
ARTIST1=Chris Taylor
ARTIST2=Chris Taylor
ARTIST3=Chris Taylor
LENGTH1=1.329
LENGTH2=1.329
LENGTH3=1.329
```



(c) (10 points) Implement the insertion operator associated with the `album` class.

3. This is a multi-part question that makes use of the following class:

```
class Date {
2 public:
    Date();
4   Date(unsigned int mn, unsigned int day, int yr);
    Date(const Date& rhs);
6   Date& operator=(const Date& rhs);
    ~Date();
8   unsigned int getMonth() const;
    unsigned int getDay() const;
10  int getYear() const;
    bool setDate(unsigned int mn, unsigned int dy, int yr);
12  Date& operator++();
    Date operator++(int);
14  Date& operator--();
    Date operator--(int);
16  void display(ostream& os) const;
    void niceDisplay(ostream& os) const;
18  bool read(istream& is);
    bool niceRead(istream& is);
20 private:
    unsigned int month;
22  unsigned int day;
    int year;
24  static const unsigned int numDays[];
    static const char* monthNames[];
26  static bool leapYear(int yr);
    static bool valid(unsigned int mn, unsigned int dy, int yr);
28  bool lastDayOfMonth() const;
};
30 ostream& operator<<(ostream& os, const Date& date);
    istream& operator>>(istream& is, Date& date);
```

(a) (10 points) Which of the member functions from the `Date` class would have been implemented by the compiler if they were not included in the definition given above?



(b) (15 points) Explain why it is not possible to write the insertion operator without first writing the `display()` function.



- (c) (20 points) Implement the prefix decrement operator. E.g.,
—date1 ;



(bonus) (10 points) (no partial credit) Implement the postfix decrement operator. E.g.,
date1--;



Additional work area for any problem. Clearly identify to which problem the work on this page is related.



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