CSC 215

Math and Computer Science

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Binary Files

- Highly formatted
- Usually not human readable
- Allow random access (records)
- Does a byte by byte copy from memory to file or from file to memory.
- You must know how the data is formatted in the file
- All data transferred in blocks as character arrays

Opening a binary file

- Change the mode
  - ifstream
    - fin.open("MyFile.ttt", ios::in | ios::binary); ← note both modes
  - ofstream
    - fout.open("MyFile.ttt", ios::out | ios:: trunc | ios::binary); ← note the 3 modes
  - fstream
    - file.open("MyFile.ttt", ios::in | ios::out | ios::app | ios::binary);

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Reading from the file

- No matter the input file type (ifstream or fstream)
- >>, getline and get no longer work correctly.
- Must use the read function

```
afile.read( (char *) , unsigned int bytesToRead );
```

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3 Main Member Functions for Input

- seekg
  - Move position for a reading
- tellg
  - Report the position for reading
- read
  - Input the data from a file to a variable

Reading from the file

- Read an integer from the file

```
int x;
afile.read( (char *) &x, sizeof( int ) );
```

- Read a double from the file

```
double n;
afile.read( (char *) &n , sizeof( double ) );
```

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Reading an array from the file

- Read an integer array from the file

```
int data[100];
afile.read( (char *) data, sizeof( int ) * 100 );
```

- Read a double from the file

```
double ddata[100];
afile.read( (char *) ddata , sizeof( double ) * 100 );
```

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Read in the Nth integer in a file

- 1st integer starts at byte 0
- 2nd integer starts at byte 4
- 3rd integer starts at byte 8….

```
int n=?, num;
afile.seekg( (n-1) * sizeof( int ), ios::beg );
afile.read( (char *) &num, sizeof( int ) );
```

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Read in the last integer in a file

```
int num;
afile.seekg( - int( sizeof( int ) ), ios::end );
afile.read( (char *) &num, sizeof( int ) );

afile.seekg( -4 , ios::end );
```

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Example 1 – File With Integers in It.

```
int count;
int *ptr;
afile.seekg( 0, ios::end );
count = afile.tellg() / sizeof( int );
ptr = new (nothrow) int [count];
afile.seekg( 0, ios::beg );
afile.read( (char *) ptr, sizeof(int) * count );
```

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Example 2 – Binary File with Structures

```
struct rec
{
    int id;
    char name[60];
    float gpa;
}; // 68 bytes per record
```

Every 68 bytes in the file is a record of type rec

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Example 2 – Binary File with Structures

Read in the first record

```
rec student;
afile.read( (char *) &student, sizeof( rec ));
```

Read in the 10th record

```
rec student;
afile.seekg( 9 * sizeof(rec) , ios::beg );
afile.read( (char *) &student, sizeof( rec ));
```

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Example 3 – Read All Records into Array

```
int count;
rec *data;
afile.seekg( 0, ios::end );
count = afile.tellg( ) / sizeof( rec );
data = new (nothrow) rec [count];
afile.seekg( 0, ios::beg );
afile.read( (char *) data, sizeof(rec) * count );
```

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Outputting to Binary Files

- No matter the output file type (ofstream or fstream)
- <<, put, and endl no longer work correctly.
- Must use the write function

```
afile.write( (char *) , unsigned int bytesToWrite );
```

3 Main Member Functions for Output

- seekp
  - Move position for a writing
- tellp
  - Report the position for writing
- write
  - output the data from a variable to a file

Writing to the file

- Writing an integer to the file

```
int x = 987342;
afile.write( (char *) &x, sizeof( int ) );
```

- Read a double from the file

```
double n=3.14159;
afile.write( (char *) &n , sizeof( double ) );
```

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Writing an Array to the File

- Write an integer array to the file

```
int data[100];
:
afile.write( (char *) data, sizeof( int ) * 100 );
```

- Write a double array to the file

```
double ddata[100];
:
afile.write( (char *) ddata, sizeof( double ) * 100 );
```

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Overwrite in the Nth integer to a file

- 1st integer starts at byte 0
- 2nd integer starts at byte 4
- 3rd integer starts at byte 8….

```
int n=?, num=9484784;
afile.seekp( (n-1) * sizeof( int ), ios::beg );
afile.write( (char *) &num, sizeof( int ) );
```

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Overwrite the last integer in a file

```
int num = 9483;
afile.seekp( - int( sizeof( int ) ), ios::end );
afile.write( (char *) &num, sizeof( int ) );

afile.seekp( -4 , ios::end );
```

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Example 4 – Write a File full of Integers

```
int count = 1000;
int *ptr;
ptr = new (nothrow) int [count];
for( i=0; i<count; i++)
    ptr[i] = rand();
afile.seekp( 0, ios::beg );
afile.write( (char *) ptr, sizeof(int) * count );
```

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Example 5 – Binary File with Structures

```
struct rec
{
    int id;
    char name[60];
    float gpa;
}; // 68 bytes per record
```

Every 68 bytes in the file is a record of type rec

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Example 6 – Binary File with Structures

```
Write the first record
rec student;
afile.seekp( 0, ios::beg)
afile.write( (char *) &student, sizeof( rec ));
```

Write the 10th record

```
rec student;
afile.seekp( 9 * sizeof(rec) , ios::beg );
afile.write( (char *) &student, sizeof( rec ));
```

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Example 7 – Write All Records to a file

```
int count = 1000;
rec *data;
data = new (nothrow) rec [count];
for( i=0; i<count; i++)
    data[i] = getStructure();
afile.seekp( 0, ios::beg );
afile.write( (char *) data, sizeof(rec) * count);
```

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Binary Files and fstreams

```
int recno;
cin >> recno;
afile.seekg((recno - 1) * sizeof(rec), ios::beg);
afile.read( (char *) &student, sizeof(rec) );
// modify the student record

afile.seekp((recno - 1) * sizeof(rec), ios::beg);
afile.write( (char *) &student, sizeof(rec) );
```

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Extra Notes

- If you have been at the end of the file, consider doing a clear in case you set the eof flag
- Use only the seekg, tellg and read functions when doing input
- Use only the seekp, tellp and write functions when doing output

Member Function Comparisons

- tellg / tellp

```
int file.tellg();
int file.tellp();
```

- seekg / seekp

```
void file.seekg( int bytes2Move, offset way );
void file.seekp( int bytes2Move, offset way );
```

- read / write

```
void afile.read( (char *) address, unsigned int bytes2Read );
void afile.write( (char *) address, unsigned int bytes2Write );
```

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