Tutorial - Week 9 Solution

Objectives: To practice with
- Text files
- Binary files

1. What is the difference between a file and a file stream?

A file is an external collection of data **that is not a part of a C program.** C must provide a linkage between the external file and the program. **The linkage is provided by File Streams**. A File Stream is an interface between a program and a physical device It separates the program from the physical device by **assigning each file a logical structure**

2. Open file `report.txt` for reading. Use appropriate error recovery in case of failure.

We'll assume that the file is a text file given its extension; therefore, the access mode is "r"

```
FILE* inFile;
char fileName[] = "report.txt";

inFile = fopen( fileName, "r" );
if( inFile == NULL )
{
fprintf( stderr, "Error opening %s", fileName );
return -1;
}
```

3. Write a fragment of a program that counts and displays the number of characters stored in a file. You can assume that the file has been opened successfully.

Answer:

As there is no indication if the file is text or binary, we'll use the function **fgetc()**

```
int character, count = 0;

while((character = fgetc(infile)) != EOF ) count++;

if(!ferror(inFile))
    printf("Num of char = %d ", count);
else
    printf("File Read Error");
```

> The C library function **int fgetc(FILE *stream)** gets the next character (an unsigned char) from the specified stream and advances the position indicator for the stream.
>
> This function returns the character read as an unsigned char cast to an int or EOF on end of file or error.
>
> The C library function int ferror (FILE *stream) tests the error indicator for the given stream.

4. **Open a binary file `results.dat` for output. If the file with such a name does not exist, it is created. If the file already exists, its content is preserved. Use appropriate error recovery in case of failure.**

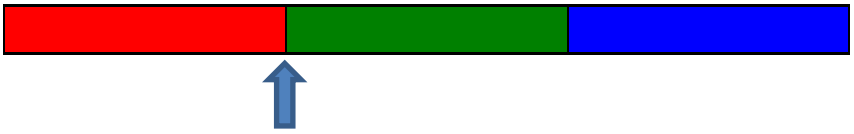
```
FILE *outFile;
char filename[] = "results.dat";

outFile = fopen( filename, "ab" );
if( outFile == NULL )
{
    /* error recovery action * /
}
```

5. **Write a fragment of a program, which reads all experiment data stored in a binary file block-by-block, calculates an average value for a block of data and prints it with 2 decimal point precision. All data are stored as type `float`. The block size is `128`. You can assume that the file has been opened successfully.**

```
#define SIZE    128
FILE * inData;
.....
float average, sum, buffer[SIZE]; int i;
while(fread( buffer, sizeof(float), SIZE, inData ) ==  SIZE)
{
     sum=0.0;
    for(i=0; i<SIZE; i++)
        sum += buffer[i];
    printf("Block average = %.2f",  sum/SIZE);
}
if(!feof(inData))
   printf("beware!!! Not all the file content has been read");
if(ferror(inData))
  printf("beware!!! Hw Failure during the processing");
```

6. **A color image file `image.raw` sequentially stores a block of red color samples, a block of green color samples followed by a block of blue color samples. Each block is of size 76800 elements of type unsigned char. Write a fragment of code that opens binary file `image.raw` for reading. Use appropriate error recovery in case of failure. Set the file position indicator to the beginning of the green color block. Use appropriate error recovery in case of failure.**



```
#define BLOCK_SIZE 76800

FILE *imageFile;
char filename[] = "image.raw";

imageFile = fopen( filename, "rb" );

if(imageFile == NULL )
     return -1;

if( fseek(imageFile, BLOCK_SIZE, SEEK_SET ) != 0 ) return -2;
```

fseek function returns zero if successful, or else it returns a non-zero value.

7. **Define a function `saveRecord()` that stores one structured variable into a binary file. You can assume that the file position indicator has already been set. Use the following structure definition.**

```
typedef struct
{
   char  level;
   int   code;
}element_t;
```

```
/*---function definition --*/
bool saveRecord( FILE* outFile, element_t record )
{
   if( fwrite( &record, sizeof(element_t), 1, outFile) == 1 )
        return true;
   else
          return false;
}
```

8. **Assume the environment shown, and complete the statements that follow so that they are valid:**

```
#define NAME_LEN 50
#define SIZE 30
typedef struct {
   char name[NAME_LEN];
   int age;
   double income;
} person_t;
. . .
int num_err[SIZE];
```

```
person_t exec;
/* binary files */
FILE *nums_inp, *psn_inp, *psn_outp, *nums_outp;
/* text files */
FILE *nums_txt_inp, *psn_txt_inp, *psn_txt_outp;
nums_inp = fopen("nums.bin", "rb");
nums_txt_inp = fopen("nums.txt", "r");
psn_inp = fopen("persons.bin", "rb");
psn_txt_inp = fopen("persons.txt", "r");
psn_outp = fopen("persout.bin", "wb");
psn_txt_outp = fopen("persout.txt", "w");
nums_outp = fopen("numsout.bin", "wb");
```

a. fscanf(psn_txt_____, "%s", _____);

b. fwrite(num_err, _____, _____, nums_outp);

c. fprintf(psn_txt_outp, "%s %d %f\n", _____, _____, _____);

```
a. fscanf(psn_txt_inp, "%s", exec.name);
b. fwrite(num_err, sizeof (int), SIZE, nums_outp);
c. fprintf(psn_txt_outp, "%s %d %f\n", exec.name, exec.age,
   exec.income);
```

9. Write a void function `make_product_file` that would convert a text file containing product information to a binary file of `product_t` structures. The function's parameters are file pointers to the text input and binary output files.

```
typedef struct {                    /* product structure type */
   int stock_num;                   /* stock number */
   char category[STR_SIZ];
   char tech_descript[STR_SIZ];
   double price;
 } product_t;

      /*
       * Converts a text file of product data to a binary file of
```

```
        product structures.
      */

void
    make_product_file(FILE *fpin,     /*  file pointer to text
                                           input file */
                      FILE *fpout)    /*  file pointer to binary
                                           ouput file */
    {
      product_t p;
      int status;
while(fscanf(fpin, "%d%s%s%lf",  &p.stock_num,p.category, p.tech_descript, &p.price)==4)
       {
         status=fwrite(&p, sizeof(p), 1, fpout);
         if(status<0)
             {
              printf(" error during the writing);
              break;
              }
       }
    }

if(!feof(fpin))
printf(" BEWARE!!! The input file was not read fully \n");

if(ferror(fpin)|| ferror(fpout))
printf(" BEWARE!!! There was a Hw Failure during the file
processing \n");
```

10. Consider a file `empstat.txt` that contains employee records. The data for each employee consist of the employee's name (up to 20 characters), social security number (up to 11 characters), gross pay for the week (`double`), taxes deducted (double), and net pay (`double`) for the week. Each record is a separate text line in file `empstat.txt`. Write a program that will create a text file `report.txt` with the heading line:

NAME SOC.SEC.NUM GROSS TAXES NET

followed by two blank lines and the pertinent information under each column heading. The program should also produce a binary file version of `empstat.txt` named `empstat.bin`.

```
#include <stdio.h>

#define NAME_LEN 21
#define SOCSEC_LEN 12

typedef struct {
        char   name[NAME_LEN];
        char   socsec[SOCSEC_LEN];
        double gross, taxes, net;
} emppay_t;
```

```
    int main(void)
    {
       FILE *fpin, *fpout, *fpbin;
       emppay_t emp;
       int status;

       if ((fpin = fopen("empstat.txt", "r")) == NULL)
          printf("Unable to open empstat.txt.\n");
       else if ((fpout = fopen("report.txt", "w")) == NULL)
          printf("Unable to open report.txt.\n");
       else if ((fpbin = fopen("empstat.bin", "w")) == NULL)
          printf("Unable to open empstat.bin.\n");
       else {
          fprintf(fpout, "NAME SOC.SEC.NUM GROSS  TAXES  NET\n\n");
while (fscanf(fpin, "%s%s%lf%lf%lf", emp.name,emp.socsec, &emp.gross,
&emp.taxes,&emp.net)==5))
          {
             fprintf(fpout, "%-20s%-lls  %8.2f  %8.2f  %8.2f\n",
                      emp.name, emp.socsec, emp.gross, emp.taxes,
                      emp.net);
             fwrite(&emp, sizeof (emppay_t), 1, fpbin);
          }
       }
       if (fpin != NULL) fclose(fpin);
       if (fpout != NULL) fclose(fpout);
       if (fpbin != NULL) fclose(fpbin);

       return (0);
    }
```

Alternatively, you could have for each file stream , a dedicated fopen, then error recovery in case the file stream was not set up, i.e. remained NULL.