CSE216 Programming Abstractions
File I/O

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Some Functions for File I/O

```c
#include <stdio.h>

//open a file for reading and/or writing
FILE *fopen(const char *pathname, const char *mode);

//close a file
int fclose(FILE *stream);

//write a formatted string to a file
int fprintf(FILE *stream, const char*format, ...);

//read a formatted data from a file
int fscanf(FILE *stream, const char *format, ...);
```

Some Functions for File I/O

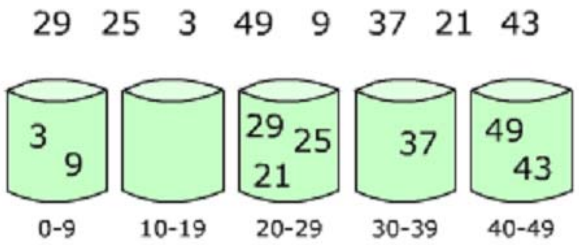
```
//read nmemb elements of size data from file
size_t fread(void *ptr, size_t size, size_t nmemb, FILE *stream);

//write nmemb elements of size data to file
size_t fwrite(const void *ptr, size_t size, size_t nmemb, FILE *stream);

//change the current position of the file
//   whence can be SEEK_SET, SEEK_CUR, or SEEK_END
extern int fseek(FILE *stream, long offset, int whence);
```

File I/O

```
FILE *fopen(const char *pathname, const char *mode);
/*
pathname: path to the file to open
mode:
r   Open text file for reading.
    The stream is positioned at the beginning of the file.

r+  Open for reading and writing.
    The stream is positioned at the beginning of the file.

w   Truncate file to zero length or create text file for writing.
    The stream is positioned at the beginning of the file.

w+  Open for reading and writing. The file is created if it does not exist, otherwise
    it is truncated. The stream is positioned at the beginning of the file.

a   Open for appending (writing at end of file). The file is created
    if it does not exist.  The stream is positioned at the end of the file.

a+  Open for reading and appending (writing at end of file).
    The file is created if it does not exist. Output is always appended to
    the  end of the file.

b   add b at the end or after the first character for binary files
*/
```

Bucket Sort

- Copy data to its corresponding bin and sort



- Our example:
  - Copy data at the file position (use id as an index)
  - Bin size is 1

```c
typedef struct record {
    int id;
    int age;
    char year[10];
    char name[50];
    char school[50];
    char EndOfRecord;
} record_t;

record_t data[25] = {
    {2,   23,   "junior",       "Abenner Abbe",         "SUNY Korea", ';'},
    {25,  20,   "freshman",     "Zinaida Bolormaa",     "SUNY Korea", ';'},
    {9,   22,   "sophomore",    "Elton Laurena",        "SUNY Korea", ';'},
    {11,  24,   "senior",       "Davida Marni",         "SUNY Korea", ';'},
    {17,  21,   "sophomore",    "Brigham Nellie",       "SUNY Korea", ';'},
…
};

size_t fread(void *ptr, size_t size, size_t nmemb, FILE *stream);
size_t fwrite(const void *ptr, size_t size, size_t nmemb, FILE *stream);
int fseek(FILE *stream, long offset, int whence);
//whence can be SEEK_SET, SEEK_CUR, or SEEK_END
```

```c
void print_record(record_t *rec) {
    printf("id: %-2d, age: %-2d, year: %-10s, name: %-20s, school: %s\n",
        rec->id, rec->age, rec->year, rec->name, rec->school);
}

//TODO: read rec from the file
int read_record(FILE *fp, record_t *rec) {
}

//TODO: write rec to the file
int write_record(FILE *fp, record_t *rec) {
}

//TODO: write rec to the file at the index
int write_record_at(FILE *fp, int index, record_t *rec) {
}

//TODO: sort records using the bucket sort
void sort_file(char *src_fname, char *dst_fname) {
}
```

```c
//create a file and write data to it
void create_file(char *fname) {
    FILE *fp = fopen(fname, "wb");      //"w" for linux and mac
    for(int i = 0; i < 25; i++)
        write_record(fp, &data[i]);
    fclose(fp);
}

//print the records to the file
void print_file(char *fname) {
    record_t rec;
    FILE *fp = fopen(fname, "rb");      //"r" for linux and mac
    printf("--%s----------------\n", fname);
    while(read_record(fp, &rec) > 0)
        print_record(&rec);
    fclose(fp);
}

int main() {
    create_file("original.txt");
    print_file("original.txt");

    sort_file("original.txt", "sorted.txt");
    print_file("sorted.txt");

    return 0;
}
```

Expected result

```
> a.exe
--original.txt----------------
id: 2 , age: 23, year: junior    , name: Abenner Abbe         , school: SUNY Korea
id: 25, age: 20, year: freshman  , name: Zinaida Bolormaa     , school: SUNY Korea
id: 9 , age: 22, year: sophomore , name: Elton Laurena        , school: SUNY Korea
id: 11, age: 24, year: senior    , name: Davida Marni         , school: SUNY Korea
id: 17, age: 21, year: sophomore , name: Brigham Nellie       , school: SUNY Korea
id: 18, age: 27, year: junior    , name: Mica Brooklynn       , school: SUNY Korea
id: 10, age: 21, year: junior    , name: Lester Abraham       , school: SUNY Korea
id: 13, age: 24, year: sophomore , name: Valary Shaquille     , school: SUNY Korea
id: 14, age: 25, year: junior    , name: Marion Julyan        , school: SUNY Korea
…
--sorted.txt----------------
id: 1 , age: 21, year: sophomore , name: Yeong Katyusha       , school: SUNY Korea
id: 2 , age: 23, year: junior    , name: Abenner Abbe         , school: SUNY Korea
id: 3 , age: 21, year: senior    , name: Kidist Robert        , school: SUNY Korea
id: 4 , age: 25, year: freshman  , name: Andile Aureliana     , school: SUNY Korea
id: 5 , age: 26, year: sophomore , name: Gioacchino Hadewych , school: SUNY Korea
id: 6 , age: 27, year: junior    , name: Misi Hippolytos      , school: SUNY Korea
id: 7 , age: 18, year: senior    , name: Andriy Dora          , school: SUNY Korea
id: 8 , age: 19, year: freshman  , name: Ural Gayatri         , school: SUNY Korea
id: 9 , age: 22, year: sophomore , name: Elton Laurena        , school: SUNY Korea
id: 10, age: 21, year: junior    , name: Lester Abraham       , school: SUNY Korea
…
```