

Assignment 6

C/C++ Programming II

Exercise 1 (2 points – C Program)

Exclude any existing source code files that may already be in your IDE project and add a new one, naming it **C2A6E1_GetPointers.c**. Also add instructor-supplied source code file **C2A6E1_main-Driver.c**. Do not write a `main` function! `main` already exists in the instructor-supplied file and it will use the code you write.

File **C2A6E1_GetPointers.c** must contain functions named `GetPrintfPointer` and `GetPutsPointer`.

`GetPrintfPointer` syntax:

```
int (*GetPrintfPointer(void))(const char *format, ...);
```

Parameters:

none

Synopsis:

Declares a pointer named `pPrintf` of appropriate type to point to the standard library `printf` function and initializes it to point to that function.

Return:

the initialized pointer named `pPrintf`, which points to the standard library `printf` function

`GetPutsPointer` syntax:

```
int (*GetPutsPointer(void))(const char *str);
```

Parameters:

none

Synopsis:

Declares a pointer named `pPuts` of appropriate type to point to the standard library `puts` function and initializes it to point to that function.

Return:

the initialized pointer named `pPuts`, which points to the standard library `puts` function

Never explicitly write a prototype for a library function. Instead, include the appropriate standard header file, which already contains the needed prototype.

Submitting your solution

Send both source code files to the Assignment Checker with the subject line **C2A6E1_ID**, where **ID** is your 9-character UCSD student ID.

See the course document titled "Preparing and Submitting Your Assignments" for additional exercise formatting, submission, and Assignment Checker requirements.

Hints:

Look up the standard library `printf` and `puts` functions in your IDE's built-in help, any good C programming text book, or online, and examine their prototypes.

Exercise 2 (4 points – C++ Program)

Exclude any existing source code files that may already be in your IDE project and add two new ones, naming them **C2A6E2_GetValues.cpp** and **C2A6E2_SortValues.cpp**. Also add instructor-supplied source code file **C2A6E2_main-Driver.cpp**. Do not write a main function! **main** already exists in the instructor-supplied file and it will use the code you write.

File **C2A6E2_GetValues.cpp** must contain a function named **GetValues**.

GetValues syntax:

```
float *GetValues(float *first, size_t elements);
```

Parameters:

first – a pointer to the first element of an array of **floats**

elements – the number of elements in that array

Synopsis:

Prompts the user to input **elements** whitespace-separated floating point values, which it then reads with **cin** and stores into the successive elements of the array in **first** starting with element 0.

Return:

a pointer to the first element of the array

File **C2A6E2_SortValues.cpp** must contain a function named **SortValues**.

SortValues syntax:

```
float *SortValues(float *first, size_t elements);
```

Parameters:

first – a pointer to the first element of an array of **floats**

elements – the number of elements in that array

Synopsis:

Sorts the array in **first** in descending order using the “bubble sort” algorithm

Return:

a pointer to the first element of the sorted array

- Use no global variables or global information about the array in either function.
- Do not use the syntax **pointer[offset]** or ***(pointer + offset)** to access array elements. Use ***pointer** or ***pointer++** instead.
- Use the following test values. Copying/pasting them from this document to the user prompt is an easy way to avoid retyping them each time:

1st prompt: 1.2 3.4 5 6 7.7 8e4 22.6e-4 11.22 .00 0.4

2nd prompt: -20 4 +16.8 -.0003 32.79 76 -6e6

3rd prompt: 1 2 3 4 5

Submitting your solution

Send all three source code files to the Assignment Checker with the subject line **C2A6E2_ID**, where **ID** is your 9-character UCSD student ID.

See the course document titled “Preparing and Submitting Your Assignments” for additional exercise formatting, submission, and Assignment Checker requirements.

Hints:

Do not declare any arrays or create any dynamically.

Exercise 3 (6 points – C Program)

Exclude any existing source code files that may already be in your IDE project and add a new one, naming it **C2A6E3_DisplayClassStatus.c**. Also add instructor-supplied source code file **C2A6E3_main-Driver.c**. Do not write a main function! **main** already exists in the instructor-supplied file and it will use the code you write.

A certain school keeps two sets of student names for every class taught. The first is for individuals who have registered (registrants) and the second is for individuals (registered or not) who have attended the first class meeting (attendees). This information is kept in the following standard ragged *names* array format:

```
const char *names[] = { "Al", "Ned Nasty", "Sweet L. Sally", etc. };
```

File **C2A6E3_DisplayClassStatus.c** must contain functions named **Compare**, **SortStudents**, and **DisplayClassStatus**.

Compare syntax:

```
int Compare(const void *elemA, const void *elemB);
```

Parameters:

elemA – a pointer to an element of a *names* array
elemB – a pointer to an element of a *names* array

Synopsis:

Compares the names represented by **elemA** and **elemB** using the standard library function **strcmp**.

Return:

<0 if the name represented by **elemA** is less than the name represented by **elemB**;
0 if the name represented by **elemA** is equal to the name represented by **elemB**;
>0 if the name represented by **elemA** is greater than the name represented by **elemB**.

SortStudents syntax:

```
void SortStudents(const char *studentList[], size_t studentCount);
```

Parameters:

studentList – A pointer to the first element of a *names* array
studentCount – The number of elements in the array

Synopsis:

Uses the standard library **qsort** function and the **Compare** function above to sort the array in **studentList** into alphabetical order.

Return:

void

DisplayClassStatus syntax:

```
void DisplayClassStatus(const char *registrants[], size_t registrantCount,  
                        const char *attendees[], size_t attendeeCount);
```

Parameters:

registrants – pointer to the first element of a registrants *names* array
registrantCount – the number of elements in the registrants *names* array
attendees – pointer to the first element of an attendees *names* array
attendeeCount – the number of elements in the attendees *names* array

Synopsis:

1. Determines and displays which of the registrants did not attend the first meeting by repeatedly calling the standard library **bsearch** function to search the attendees array for each name in the registrants array.

2. Determines and displays which of the attendees were not registered by repeatedly calling **bsearch** to search the registrants array for each name in the attendees array.
3. Results must be displayed in the following format, using the phrases "Not present:" and "Not registered:" as shown to differentiate the two groupings.

Not present:

Orphan Annie

Toto The Dog

Madonna

Not registered:

Little Mary

Big John

Tiny Tim

Return:

void

The same comparison function must be used for both **qsort** and **bsearch**.

Submitting your solution

Send both source code files to the Assignment Checker with the subject line **C2A6E3_ID**, where **ID** is your 9-character UCSD student ID.

See the course document titled "Preparing and Submitting Your Assignments" for additional exercise formatting, submission, and Assignment Checker requirements.

Hints:

The first argument of **bsearch** must always be the address of (a pointer to) the object to be searched for, not the value of that object.

Exercise 4 (8 points – C Program)

Exclude any existing source code files that may already be in your IDE project and add two new ones, naming them **C2A6E4_OpenFile.c** and **C2A6E4_List.c**. Also add instructor-supplied source code files **C2A6E4_List-Driver.h** and **C2A6E4_main-Driver.c**. Do not write a main function! **main** already exists in the instructor-supplied implementation file and it will use the code you write.

Regarding data type **List**, which is used in this exercise...

List is a typedef'd data type that is defined in instructor-supplied header file

C2A6E4_List-Driver.h

This header file must be included (**#include**) in any file that uses this data type.

File **C2A6E4_OpenFile.c** must contain a function named **OpenFile**.

OpenFile syntax:

```
FILE *OpenFile(const char *fileName);
```

Parameters:

fileName – a pointer to the name of the file to be opened

Synopsis:

Opens the file named in **fileName** in the read-only text mode. If the open fails an error message is output to **stderr** and the program is terminated with an error exit code.

Return:

a pointer to the open file if the open succeeds; otherwise, the function does not return.

File **C2A6E4_List.c** must contain functions named **CreateList**, **PrintList**, **FreeList**.

CreateList syntax:

```
List *CreateList(FILE *fp);
```

Parameter:

fp – a pointer to an open text file containing zero or more whitespace-separated words (strings)

Synopsis:

Reads strings from the text file in **fp** and creates a new non-sorted singly-linked list in which each node represents a unique case-dependent string found in the file. As each string is read the current list is searched for a node that may already exist for that string. If one is found, its string occurrence count is merely incremented. If none is found, a new node is created at the head of the list (pushed) to represent the new string, and its occurrence count is set to 1. Reading of the file stops when EOF is reached.

Return:

the list's head pointer.

Examples:

A list with 9 nodes will be created if the file contains:

```
Is it the day the earth stood still? It is!
```

but a list with 11 nodes will be created if the file contains:

```
Is it the day the earth stood still ? It is !
```

In both cases the count in each node will be 1 except for the **"the"** node, which will contain a count of 2. Note that **"Is"** differs from **"is"** and **"it"** differs from **"It"** due to case, and each will get a separate node.

PrintList syntax:

```
List *PrintList(const List *head);
```

Parameter:

head – the head pointer to the previously-described list

Synopsis:

Displays a non-sorted table of the data attributes from the list whose head pointer is passed to it, starting at the head of the list. The display must be in the format illustrated on the next page, in which the first character in each string is aligned and the least significant digits of the occurrence counts are aligned. There are no blank lines between entries.

Return:

head

Display Table Example:

the	107	ea
White	25	ea
White?	4	ea
if	16	ea
etc...		

FreeList syntax:

void FreeList(List *head);

Parameter:

head – the head pointer to the previously-described list

Synopsis:

Frees all dynamic allocations in the list.

Return:

void

Restrictions:

The **FreeList** function must call no functions or macros other than the standard library *free* function, which it may call as needed.

- Do not sort the list; push each new node onto the top.
- Do not attempt to read the entire input file into your program at once.
- Test the program on instructor-supplied input file **TestFile1.txt**. If you have placed it in the appropriate directory the instructor-supplied implementation file will use it automatically.

Submitting your solution

Send all four source code files to the Assignment Checker with the subject line **C2A6E4_ID**, where **ID** is your 9-character UCSD student ID.

See the course document titled “Preparing and Submitting Your Assignments” for additional exercise formatting, submission, and Assignment Checker requirements.

Hints:

Do not allocate space for a new node until you have searched the existing list and have not found an existing node for the current string. Be sure to allow space for the null terminator, '**\0**', when allocating space for strings. Be sure to free the string associated with a node before freeing the node itself.

Get a Consolidated Assignment Report (optional)

If you would like to receive a consolidated report containing the results of the most recent version of each exercise submitted for this assignment, send an empty email to the assignment checker with the subject line **C2A6_ID**, where **ID** is your 9-character UCSD student ID. Inspect the report carefully since it is what I will be grading. You may resubmit exercises and report requests as many times as you wish before the assignment deadline.