Yeditepe University
Department of Computer Engineering

CSE 232
Systems Programming
Spring 2022

Term Project

Due to: 30th May 2022

In this project you will implement a **preprocessor** to process shortcuts for arithmetic operations on arrays.

You will use **C language** for programming. Use **gcc** compiler in Linux environment. Prior to project submission, you must make sure that your project executes correctly with the specified setting. Projects producing errors during the demonstrations due to the differences in the platform will not be accepted.

Your preprocessor should read a C file with preprocessor commands, parse the commands into its tokens and expand the commands by substituting the appropriate C codes. Preprocessor commands start with "$".

Following preprocessor commands must be implemented:

Declaration

$dec(array, n, type)

Declares an array with n elements, of the given type (eg. int, float, char).

ex: `$dec(A, 10, int)` → `declares 1D integer array A with 10 elements`

Input

$read(file, array)

Reads n elements of the array from the file.

ex: `$read(f1, A)` → `reads all elements of 1D array A from file f1`

Output

$print(array)

Prints the array elements on the screen.

ex: `$print(A)` → `prints array A on the screen`

Copy

$destination = $source

Copies all elements of source array to destination array.

ex: `$A = $B` → `copies 5 elements form array B to array A`

Initialization

$array = x

Sets all array elements to value x.

ex: `$A = 0` → `sets array elements to 0`

Arithmetic operations

Performs four arithmetic operations (+, -, *, /) on arrays.

ex:
```
$Y = $A + $B
$Y = $A - $B
$Y = $A * $B
$Y = $A / $B
$Y = $A + 5
$A = $A - 1
$A = $A * 3
$A = $A / 2
$Y = 2 / $A
```

Example:

C code with preprocessor commands

```
int main()
{
      $dec(A, 10, int);
      $dec(B, 10, int);
      $dec(C, 10, int);

      $read(f1, A);



      $B = 5;

      $C = $A + $B;

      $print(C);


}
```

Expanded C code

```
int main()
{
      int A[10];
      int B[10];
      int C[10];

      FILE *ff=fopen("f1", "r");
      for (int i=0; i<10; i++)
            fscanf(ff, "%d", &A[i]);
      close(ff);
      for (int i=0; i<10; i++)
            B[i]=5;
      for (int i=0; i<10; i++)
            C[i]=A[i]+B[i];
      for (int i=0; i<10; i++)
            printf("%d ", &C[i]);
      printf("\n");
}
```

Use the following data structure to keep the information about the arrays. Array table is global.

```
struct ArrayTable {
      char  name[10];   // array name
      char  size[5];    // array size
      char  type[10];   // int, float, etc.
};
struct ArrayTable AT[20];
```

Write a parser to parse the preprocessor commands in the C program. Also, write the following functions to expand each command:

```
void declare();
void read();
void print();
void copy();
void initialize();
void arithmetic();
```