UNIX
ASSIGNMENT-03

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Sec-A

Question..

Create shell scripts for generating static and dynamic libraries. Utilize an example of your preference. Ensure that the program is not a simple calculator task and also from the provided tutorial material. Each program should incorporate a minimum of two functions based on the selected task.

Note: Upload your submission in a format consistent with the example provided in the material, and include a single text file containing your code.

Example:

```c
//fact.c
#include<stdio.h>

int factorial(int n) {
    if (n == 0 || n == 1) {
        printf("Factorial of %d is %d\n", n, 1);
        return 1;
    } else {
        int result = n * factorial(n - 1);
        printf("Factorial of %d is %d\n", n, result);
        return result;
    }
}
```

```c
//sum.c
#include<stdio.h>
int sumOfDigits(int num) {
    int sum = 0;
    int originalNum = num;

    while (num != 0) {
        int digit = num % 10;
        sum += digit;
        printf("Adding digit %d to the sum. Current sum: %d\n", digit, sum);
        num /= 10;
    }
    printf("Sum of digits of %d is: %d\n", originalNum, sum);
}
```

```c
//head.h
int factorial(int num);
int sumOfDigits(int num);
```

```c
// main.c
#include <stdio.h>
#include "head.h"

void main() {
    int num=12;
    factorial(num);
    sumOfDigits(num);
}
```

Output:

```
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ls
eg_dynamic.so  eg_static.a  fact.c  fact_obj.o  head.h  main.c  main_obj.o  main_result  staticlink.png  sum.c  sum_obj.o
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ gcc -o main_result main_obj.o -L. eg_dynamic.so
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ./main_result
./main_result: error while loading shared libraries: eg_dynamic.so: cannot open shared object file: No such file or directory
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ sudo cp eg_dynamic.so /usr/lib
[sudo] password for student:
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ./main_result
Factorial of 1 is 1
Factorial of 2 is 2
Factorial of 3 is 6
Factorial of 4 is 24
Factorial of 5 is 120
Factorial of 6 is 720
Factorial of 7 is 5040
Factorial of 8 is 40320
Factorial of 9 is 362880
Factorial of 10 is 3628800
Factorial of 11 is 39916800
Factorial of 12 is 479001600
Adding digit 2 to the sum. Current sum: 2
Adding digit 1 to the sum. Current sum: 3
Sum of digits of 12 is: 3
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ sudo rm /usr/lib/eg_dynamic.so
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ pwd
/home/student/Desktop/422150/unix-scripts/w6
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ export LD_LIBRARY_PATH=:home/student/Desktop/422150/unix-scripts/w6
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ./main_result
Factorial of 1 is 1
Factorial of 2 is 2
Factorial of 3 is 6
Factorial of 4 is 24
Factorial of 5 is 120
Factorial of 6 is 720
Factorial of 7 is 5040
Factorial of 8 is 40320
Factorial of 9 is 362880
Factorial of 10 is 3628800
Factorial of 11 is 39916800
Factorial of 12 is 479001600
Adding digit 2 to the sum. Current sum: 2
Adding digit 1 to the sum. Current sum: 3
Sum of digits of 12 is: 3
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ls
eg_dynamic.so  eg_static.a  fact.c  fact_obj.o  head.h  main.c  main_obj.o  main_result  staticlink.png  sum.c  sum_obj.o
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ldd main_result
```

```
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ export LD_LIBRARY_PATH=:home/student/Desktop/422150/unix-scripts/w6
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ./main_result
Factorial of 1 is 1
Factorial of 2 is 2
Factorial of 3 is 6
Factorial of 4 is 24
Factorial of 5 is 120
Factorial of 6 is 720
Factorial of 7 is 5040
Factorial of 8 is 40320
Factorial of 9 is 362880
Factorial of 10 is 3628800
Factorial of 11 is 39916800
Factorial of 12 is 479001600
Adding digit 2 to the sum. Current sum: 2
Adding digit 1 to the sum. Current sum: 3
Sum of digits of 12 is: 3
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ls
eg_dynamic.so  eg_static.a  fact.c  fact_obj.o  head.h  main.c  main_obj.o  main_result  staticlink.png  sum.c  sum_obj.o
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$ ldd main_result
        linux-vdso.so.1 (0x00007ffcddfb2000)
        eg_dynamic.so (0x00007efe2da5d000)
        libc.so.6 => /lib/x86_64-linux-gnu/libc.so.6 (0x00007efe2d841000)
        /lib64/ld-linux-x86-64.so.2 (0x00007efe2da69000)
(base) student@welcome:~/Desktop/422150/unix-scripts/w6$
```

**

//create_node.c:

```c
#include <stdio.h>
#include <stdlib.h>
#include "unique_functions.h"
```

```c
Node* createNode(int data) {
    Node* newNode = (Node*)malloc(sizeof(Node));
    if (newNode == NULL) {
        printf("Memory allocation failed\n");
        exit(EXIT_FAILURE);
    }
    newNode->data = data;
    newNode->next = NULL;
    return newNode;
}
```

```c
//delete_node.c:

#include <stdio.h>
#include <stdlib.h>
#include "unique_functions.h"

void deleteNode(Node** headRef, int key) {
    Node* temp = *headRef;
    Node* prev = NULL;

    // If head node itself holds the key to be deleted
    if (temp != NULL && temp->data == key) {
        *headRef = temp->next;
        free(temp);
        return;
    }

    // Search for the key to be deleted, keep track of the previous node as we
need to change 'prev->next'
    while (temp != NULL && temp->data != key) {
        prev = temp;
        temp = temp->next;
    }

    // If key was not present in linked list
    if (temp == NULL) {
        printf("Key not found in the linked list\n");
        return;
    }

    // Unlink the node from linked list
    prev->next = temp->next;
    free(temp);
}

//unique_functions.h:
```

```c
#ifndef UNIQUE_FUNCTIONS_H
#define UNIQUE_FUNCTIONS_H

typedef struct Node {
    int data;
    struct Node* next;
} Node;

Node* createNode(int data);
void deleteNode(Node** headRef, int key);
void printList(Node* head);

#endif /* UNIQUE_FUNCTIONS_H */
```

```c
//print_list.c:

#include <stdio.h>
#include "unique_functions.h"

void printList(Node* head) {
    printf("Linked list: ");
    while (head != NULL) {
        printf("%d ", head->data);
        head = head->next;
    }
    printf("\n");
}
```

```c
//main.c:

#include <stdio.h>
#include "unique_functions.h"

int main() {
    Node* head = NULL;

    printf("Appending elements to the linked list...\n");
    head = createNode(10);
    head->next = createNode(20);
    head->next->next = createNode(30);
    head->next->next->next = createNode(40);

    printf("Printing the linked list...\n");
    printList(head);
```

```
    printf("Deleting node with data 20...\n");
    deleteNode(&head, 20);

    printf("Printing the updated linked list...\n");
    printList(head);

    return 0;
}
```

#build_and_run.sh

```
# Compile the source files into object files
gcc -c -fPIC create_node.c delete_node.c print_list.c

# Create static library
ar rcs libunique_functions.a create_node.o delete_node.o print_list.o

# Create dynamic library
gcc -shared -o libunique_functions.so create_node.o delete_node.o print_list.o

# Check if the dynamic library was created successfully
if [ ! -f "libunique_functions.so" ]; then
    echo "Error: Unable to create the dynamic library"
    exit 1
fi

# Set library path
export LD_LIBRARY_PATH=$(pwd):$LD_LIBRARY_PATH

# Compile main program with static library
gcc main.c -L. -lunique_functions -o main_static

# Check if the main program was compiled successfully
if [ ! -f "main_static" ]; then
    echo "Error: Unable to compile the main program with static library"
    exit 1
fi

# Compile main program with dynamic library
gcc main.c -L. -lunique_functions -o main_dynamic

# Check if the main program was compiled successfully
if [ ! -f "main_dynamic" ]; then
    echo "Error: Unable to compile the main program with dynamic library"
    exit 1
fi
```

```
# Execute main programs
echo "Executing main program with static library..."
./main_static

echo "Executing main program with dynamic library..."
./main_dynamic

# Clean up object files and executables
rm *.o libunique_functions.a libunique_functions.so main_static main_dynamic
```

Output: