UNIX ASSIGNMENT – 4

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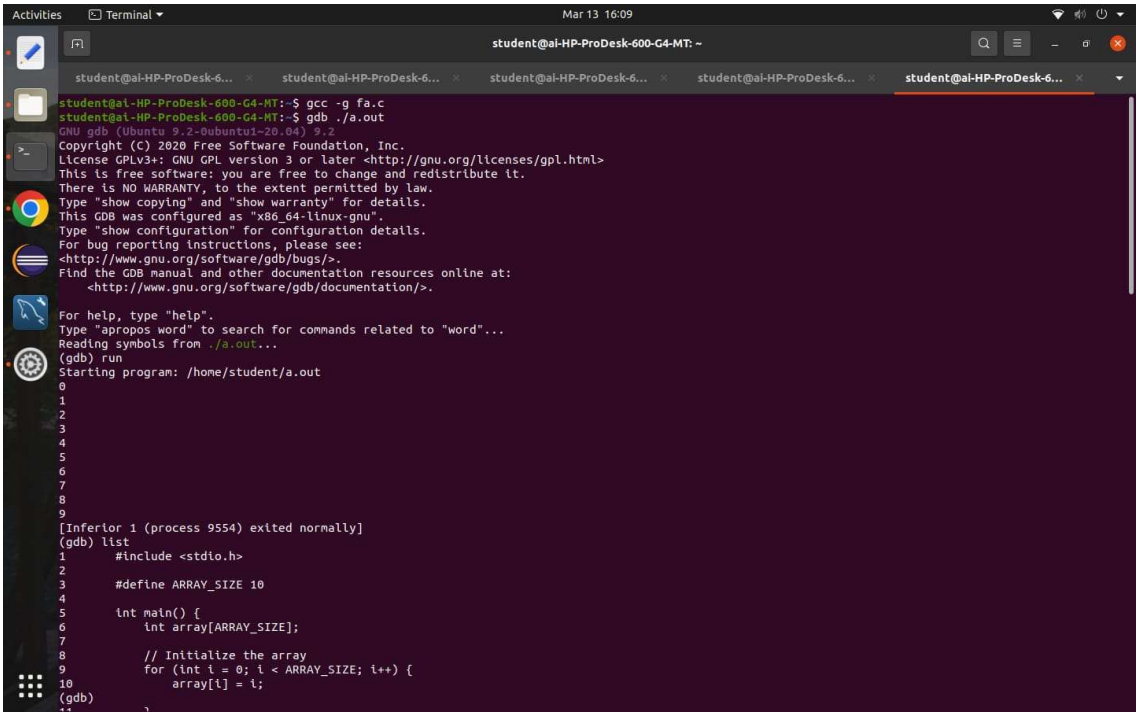
SECTION : A

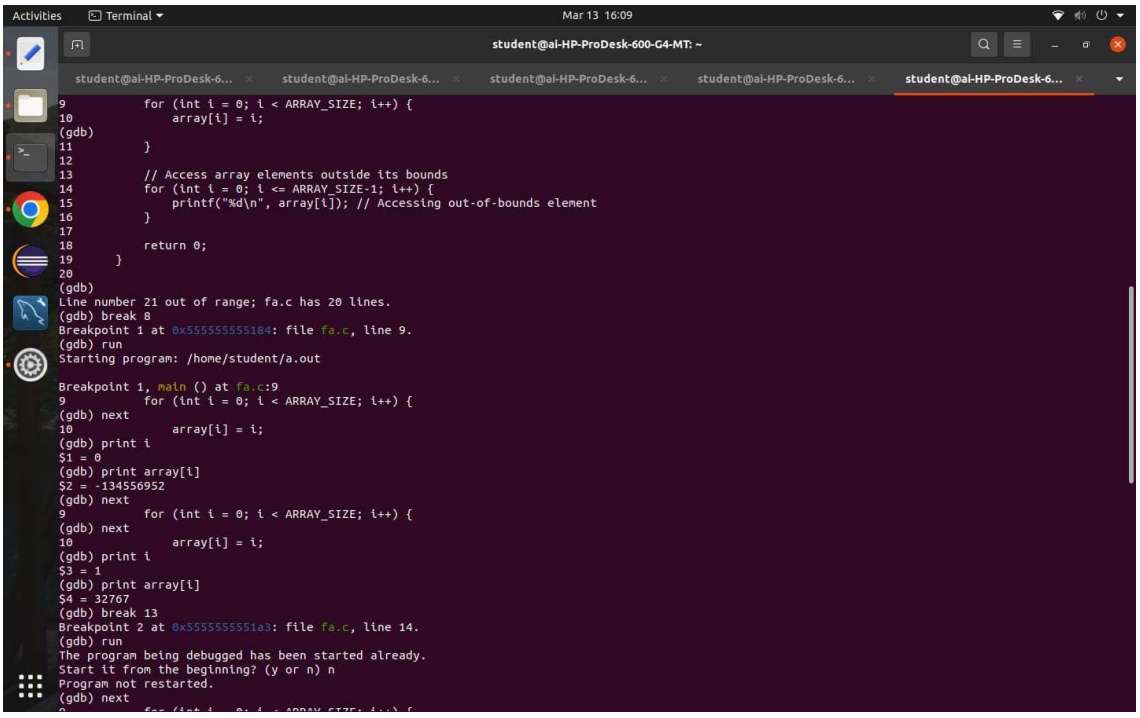
Generate different C programs that induce a segmentation fault error, select these examples of your choice, and employ the GDB utility for debugging on Linux

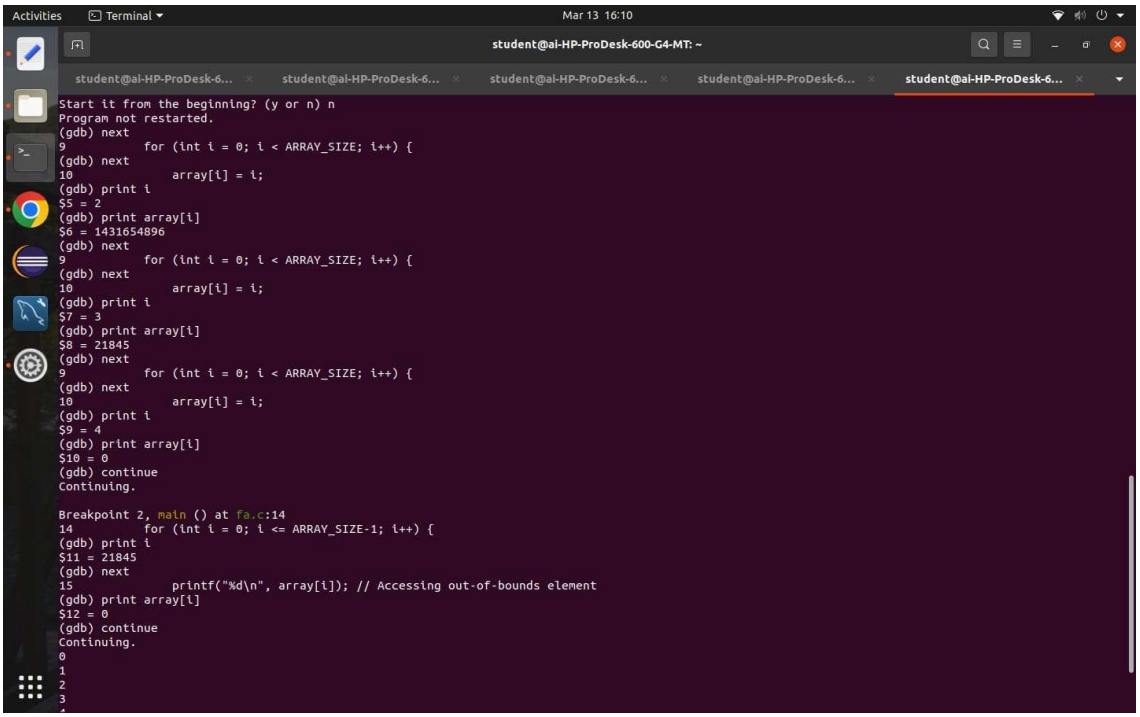
1.Factorial:

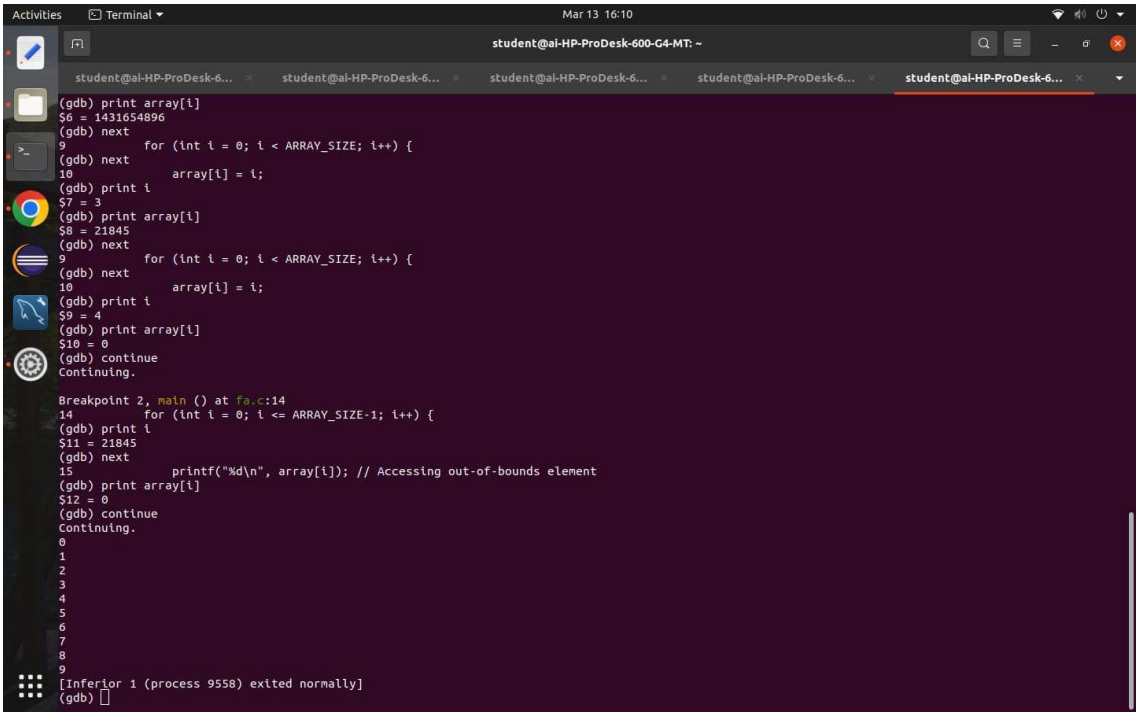
```
#include <stdio.h>
int main() {
   int num;
   unsigned long long factorial = 1;
   printf("Enter a positive integer: ");
   scanf("%d", &num);
   if (num < 0) {
      printf("Factorial of a negative number is not defined.\n");
   } else {
      int i = 1;

      while(i<=num) {
         factorial *= i;
         i++;
         printf("Factorial of %d is %llu\n", num, factorial);
      }
   }
   return 0;
}
```

GNU debugger:







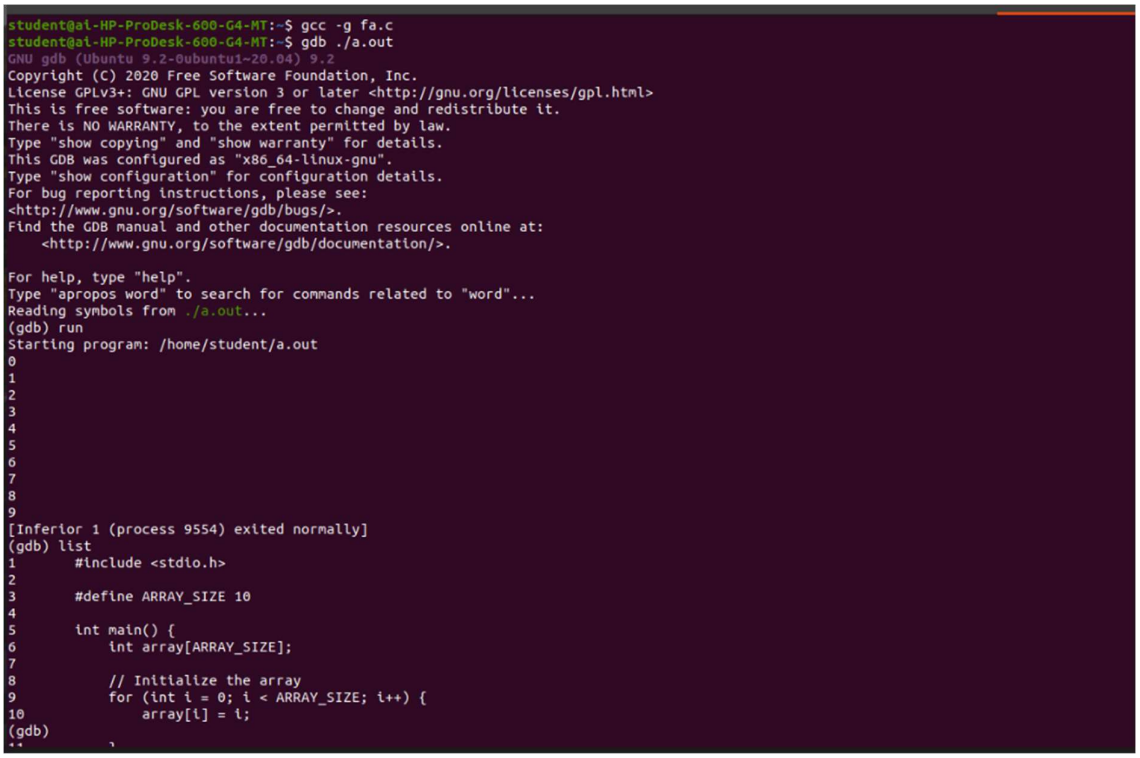


2.Array:

```
#include <stdio.h>

#define ARRAY_SIZE 10

int main() {
    int array[ARRAY_SIZE];
```

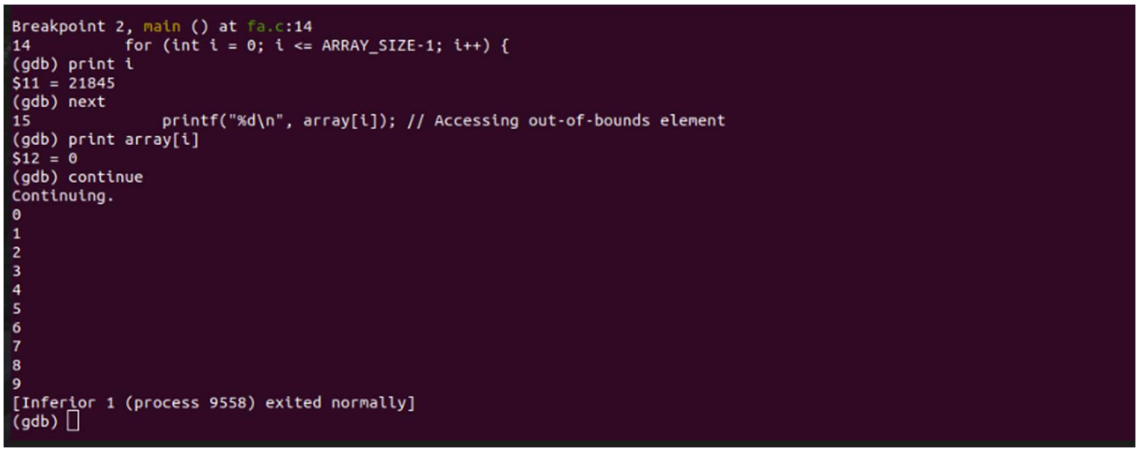
```
    // Initialize the array
    for (int i = 0; i < ARRAY_SIZE; i++) {
        array[i] = i;
    }

    // Access array elements outside its bounds
    for (int i = 0; i <= ARRAY_SIZE-1; i++) {
        printf("%d\n", array[i]); // Accessing out-of-bounds element
    }

    return 0;
}
```

GNU debugger:



```
9           for (int i = 0; i < ARRAY_SIZE; i++) {
10              array[i] = i;
(gdb)
11          }
12
13          // Access array elements outside its bounds
14          for (int i = 0; i <= ARRAY_SIZE-1; i++) {
15              printf("%d\n", array[i]); // Accessing out-of-bounds element
16          }
17
18          return 0;
19      }
20
(gdb)
Line number 21 out of range; fa.c has 20 lines.
(gdb) break 8
Breakpoint 1 at 0x555555555184: file fa.c, line 9.
(gdb) run
Starting program: /home/student/a.out

Breakpoint 1, main () at fa.c:9
9           for (int i = 0; i < ARRAY_SIZE; i++) {
(gdb) next
10              array[i] = i;
(gdb) print i
$1 = 0
(gdb) print array[i]
$2 = -134556952
(gdb) next
9           for (int i = 0; i < ARRAY_SIZE; i++) {
(gdb) next
10              array[i] = i;
(gdb) print i
$3 = 1
(gdb) print array[i]
$4 = 32767
(gdb) break 13
Breakpoint 2 at 0x5555555551a3: file fa.c, line 14.
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) n
Program not restarted.
(gdb) next
```

```
Start it from the beginning? (y or n) n
Program not restarted.
(gdb) next
9           for (int i = 0; i < ARRAY_SIZE; i++) {
(gdb) next
10              array[i] = i;
(gdb) print i
$5 = 2
(gdb) print array[i]
$6 = 1431654896
(gdb) next
9           for (int i = 0; i < ARRAY_SIZE; i++) {
(gdb) next
10              array[i] = i;
(gdb) print i
$7 = 3
(gdb) print array[i]
$8 = 21845
(gdb) next
9           for (int i = 0; i < ARRAY_SIZE; i++) {
(gdb) next
10              array[i] = i;
(gdb) print i
$9 = 4
(gdb) print array[i]
$10 = 0
(gdb) continue
Continuing.

Breakpoint 2, main () at fa.c:14
14          for (int i = 0; i <= ARRAY_SIZE-1; i++) {
(gdb) print i
$11 = 21845
(gdb) next
15              printf("%d\n", array[i]); // Accessing out-of-bounds element
(gdb) print array[i]
$12 = 0
(gdb) continue
Continuing.
0
1
2
3
```


Breakpoint 2, main () at fa.c:14
14 for (int i = 0; i <= ARRAY_SIZE-1; i++) {
(gdb) print i
$11 = 21845
(gdb) next
15 printf("%d\n", array[i]); // Accessing out-of-bounds element
(gdb) print array[i]
$12 = 0
(gdb) continue
Continuing.
0
1
2
3
4
5
6
7
8
9
[Inferior 1 (process 9558) exited normally]
(gdb)