ROLL NO : 422176
NAME : KOTA VENKATA CHARAN TEJA
SECTION:A
QUESTION:

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.

Note:
1. Include multiple breakpoints while debugging
2. Upload your submission in a format consistent with the example provided in the material

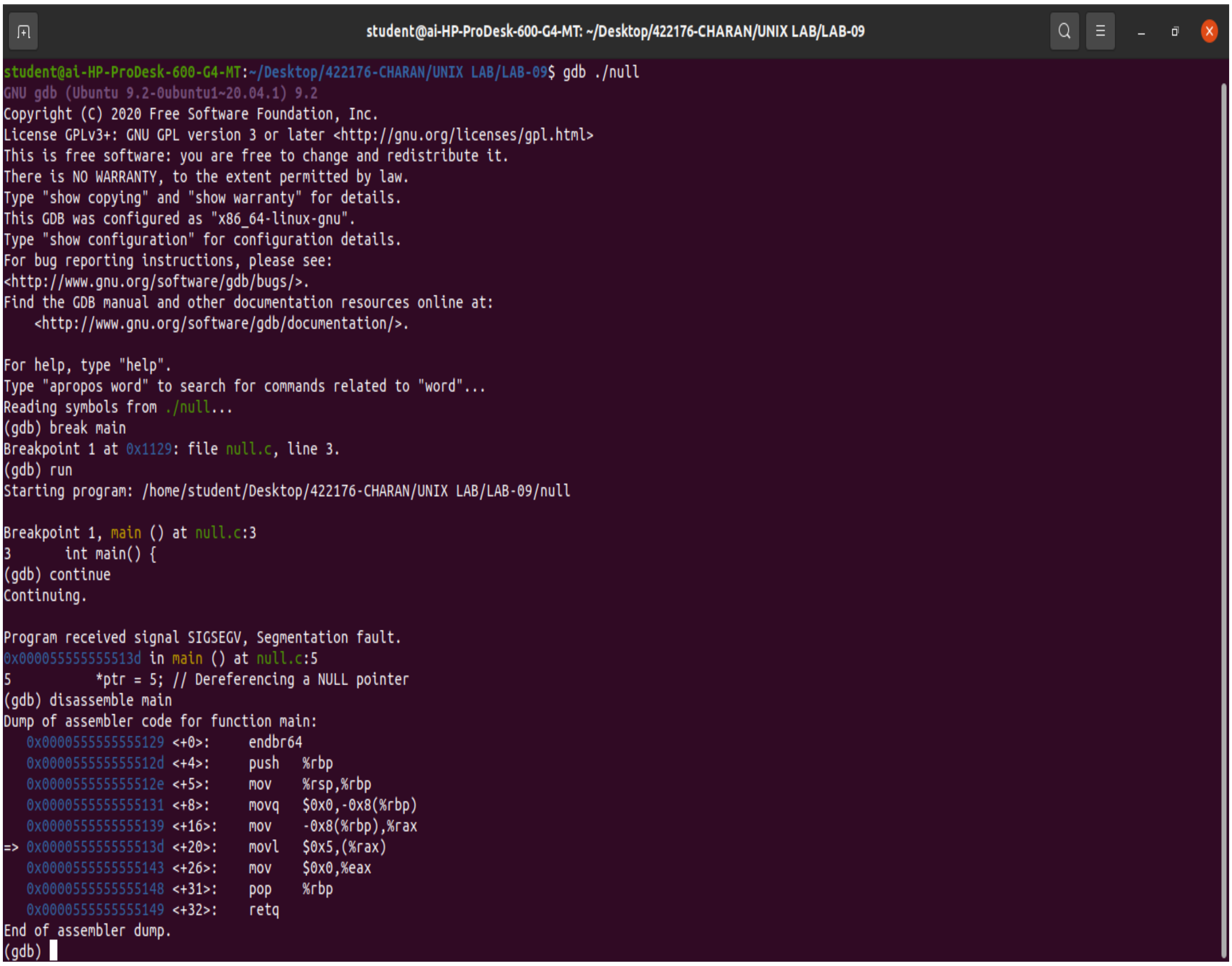
CODE:

null.c

```
#include <stdio.h>

int main() {
    int *ptr = NULL;
    *ptr = 5; // Dereferencing a NULL pointer
    return 0;
}
```

DEBUGGING null.c



student@ai-HP-ProDesk-600-G4-MT: ~/Desktop/422176-CHARAN/UNIX LAB/LAB-09

```
student@ai-HP-ProDesk-600-G4-MT:~/Desktop/422176-CHARAN/UNIX LAB/LAB-09$ gdb ./null
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
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This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
    <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./null...
(gdb) break main
Breakpoint 1 at 0x1129: file null.c, line 3.
(gdb) run
Starting program: /home/student/Desktop/422176-CHARAN/UNIX LAB/LAB-09/null

Breakpoint 1, main () at null.c:3
3       int main() {
(gdb) continue
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x000055555555513d in main () at null.c:5
5           *ptr = 5; // Dereferencing a NULL pointer
(gdb) disassemble main
Dump of assembler code for function main:
   0x0000555555555129 <+0>:     endbr64
   0x000055555555512d <+4>:     push   %rbp
   0x000055555555512e <+5>:     mov    %rsp,%rbp
   0x0000555555555131 <+8>:     movq   $0x0,-0x8(%rbp)
   0x0000555555555139 <+16>:    mov    -0x8(%rbp),%rax
=> 0x000055555555513d <+20>:    movl   $0x5,(%rax)
   0x0000555555555143 <+26>:    mov    $0x0,%eax
   0x0000555555555148 <+31>:    pop    %rbp
   0x0000555555555149 <+32>:    retq
End of assembler dump.
(gdb) 
```

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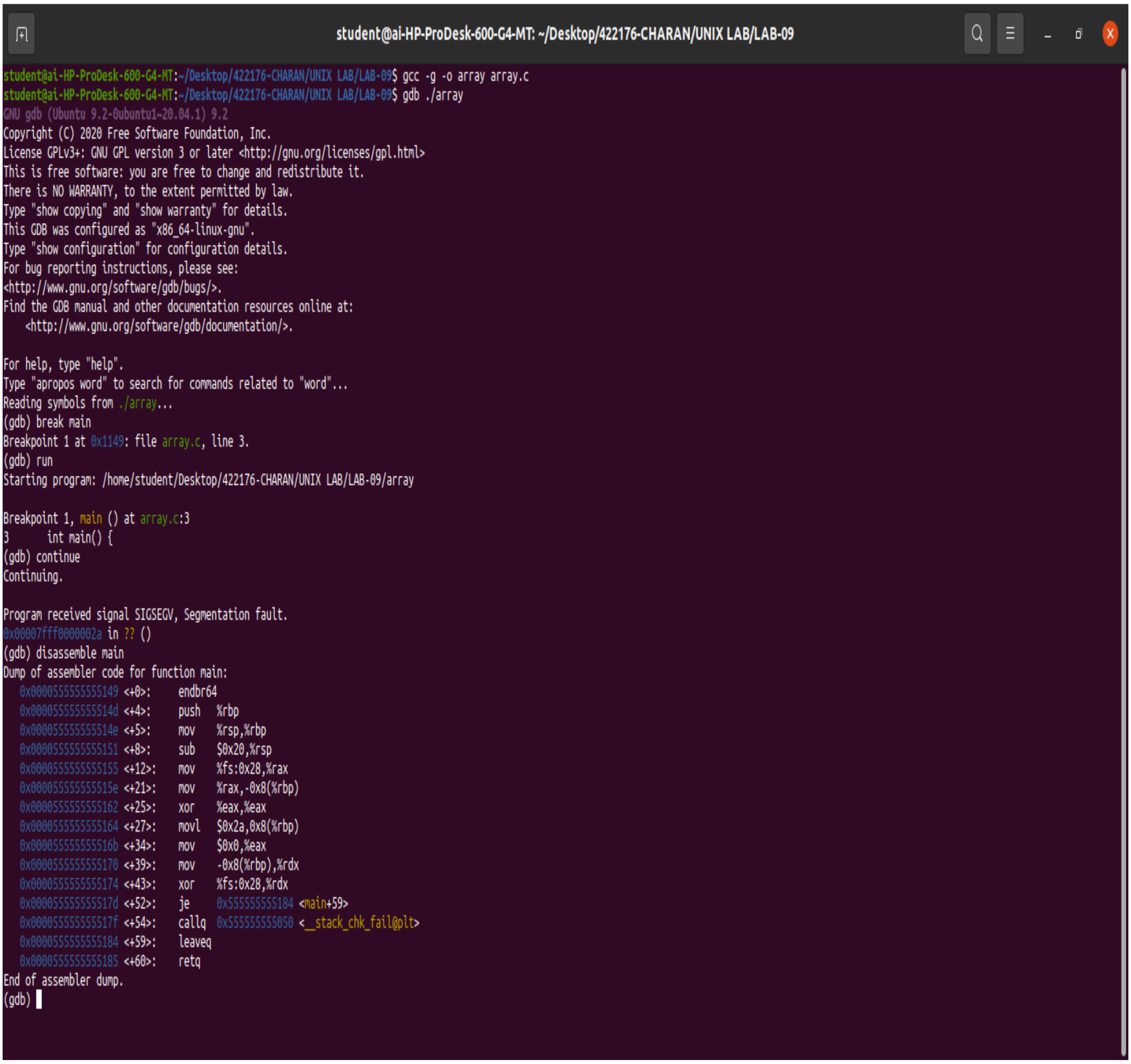
array.c

```
#include <stdio.h>

int main() {
    int arr[5];
    arr[10] = 42; // Accessing an array out of bounds
    return 0;
}
```

DEBUGGING array.c


student@ai-HP-ProDesk-600-G4-MT: ~/Desktop/422176-CHARAN/UNIX LAB/LAB-09

```
student@ai-HP-ProDesk-600-G4-MT:~/Desktop/422176-CHARAN/UNIX LAB/LAB-09$ gcc -g -o array array.c
student@ai-HP-ProDesk-600-G4-MT:~/Desktop/422176-CHARAN/UNIX LAB/LAB-09$ gdb ./array
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
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License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
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Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
    <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./array...
(gdb) break main
Breakpoint 1 at 0x1149: file array.c, line 3.
(gdb) run
Starting program: /home/student/Desktop/422176-CHARAN/UNIX LAB/LAB-09/array

Breakpoint 1, main () at array.c:3
3       int main() {
(gdb) continue
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x00007fff0000002a in ?? ()
(gdb) disassemble main
Dump of assembler code for function main:
   0x0000555555555149 <+0>:     endbr64
   0x000055555555514d <+4>:     push   %rbp
   0x000055555555514e <+5>:     mov    %rsp,%rbp
   0x0000555555555151 <+8>:     sub    $0x20,%rsp
   0x0000555555555155 <+12>:    mov    %fs:0x28,%rax
   0x000055555555515e <+21>:    mov    %rax,-0x8(%rbp)
   0x0000555555555162 <+25>:    xor    %eax,%eax
   0x0000555555555164 <+27>:    movl   $0x2a,0x8(%rbp)
   0x000055555555516b <+34>:    mov    $0x0,%eax
   0x0000555555555170 <+39>:    mov    -0x8(%rbp),%rdx
   0x0000555555555174 <+43>:    xor    %fs:0x28,%rdx
   0x000055555555517d <+52>:    je     0x555555555184 <main+59>
   0x000055555555517f <+54>:    callq  0x555555555050 <__stack_chk_fail@plt>
   0x0000555555555184 <+59>:    leaveq
   0x0000555555555185 <+60>:    retq
End of assembler dump.
(gdb) 
```

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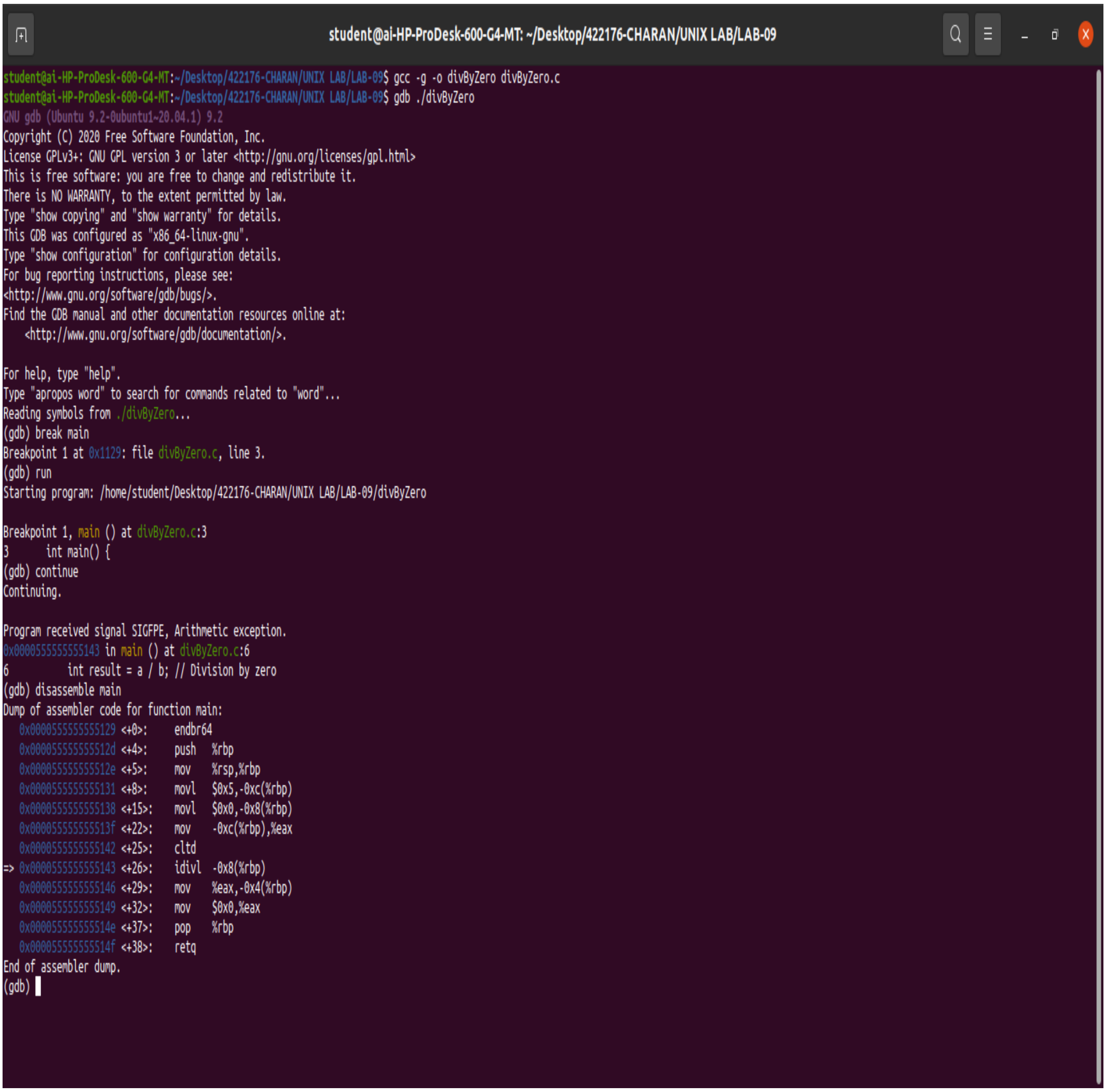
divByZero.c

```
#include <stdio.h>

int main() {
    int a = 5;
    int b = 0;
    int result = a / b; // Division by zero
    return 0;
}
```

DEBUGGING divByZero.c


student@ai-HP-ProDesk-600-G4-MT: ~/Desktop/422176-CHARAN/UNIX LAB/LAB-09

```
student@ai-HP-ProDesk-600-G4-MT:~/Desktop/422176-CHARAN/UNIX LAB/LAB-09$ gcc -g -o divByZero divByZero.c
student@ai-HP-ProDesk-600-G4-MT:~/Desktop/422176-CHARAN/UNIX LAB/LAB-09$ gdb ./divByZero
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
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License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
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This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
    <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./divByZero...
(gdb) break main
Breakpoint 1 at 0x1129: file divByZero.c, line 3.
(gdb) run
Starting program: /home/student/Desktop/422176-CHARAN/UNIX LAB/LAB-09/divByZero

Breakpoint 1, main () at divByZero.c:3
3       int main() {
(gdb) continue
Continuing.

Program received signal SIGFPE, Arithmetic exception.
0x0000555555555143 in main () at divByZero.c:6
6           int result = a / b; // Division by zero
(gdb) disassemble main
Dump of assembler code for function main:
   0x0000555555555129 <+0>:     endbr64
   0x000055555555512d <+4>:     push   %rbp
   0x000055555555512e <+5>:     mov    %rsp,%rbp
   0x0000555555555131 <+8>:     movl   $0x5,-0xc(%rbp)
   0x0000555555555138 <+15>:    movl   $0x0,-0x8(%rbp)
   0x000055555555513f <+22>:    mov    -0xc(%rbp),%eax
   0x0000555555555142 <+25>:    cltd
=> 0x0000555555555143 <+26>:    idivl  -0x8(%rbp)
   0x0000555555555146 <+29>:    mov    %eax,-0x4(%rbp)
   0x0000555555555149 <+32>:    mov    $0x0,%eax
   0x000055555555514e <+37>:    pop    %rbp
   0x000055555555514f <+38>:    retq
End of assembler dump.
(gdb) 
```