Software Engineering

Assignments-3 on gdb

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Section - A3

The program code is as follows:

```
#include <stdio.h>
#include <stdlib.h>
enum states {
   START,
   LOOP,
   END,
} state;

enum events {
   START_LOOPING,
   PRINT_HELLO,
   STOP_LOOPING,
};
void step_state(enum events event) {
   switch(state) {
   case START:
      switch(event) {
      case START_LOOPING:
         state = LOOP;
         break;
      default:
         exit(1);
         break;
      }
      break;
   case LOOP:
      switch(event) {
      case PRINT_HELLO:
         printf("Hello World!\n");
         break;
      case STOP_LOOPING:
         state = END;
         break;
```

```
      default:
         exit(1);
         break;
      }
      break;
   case END:
      exit(1);
      break;
   }
}
int main(void) {
   int cntr =0 ;
   events events_arr[] = { START_LOOPING, PRINT_HELLO, PRINT_HELLO, PRINT_HELLO,
PRINT_HELLO,
PRINT_HELLO,PRINT_HELLO,PRINT_HELLO,STOP_LOOPING,PRINT_HELLO,PRINT_HELLO,STOP_
LOOPING};
   while(events_arr[cntr] != STOP_LOOPING)
   {
      step_state(events_arr[cntr]);
      cntr++;
   }

   if (cntr == 10) {
      printf("PASS");
   } else {
      printf("FAIL %d", cntr);
   }

   return 0;
}
```

1. Consider the program in Assign3.It is a simple state machine.
    a. Put a breakpoint in line 49

Ans - break e.c:49

```
(gdb) break e.c:49
Breakpoint 1 at 0x40155a: file e.c, line 49.
```

    b. Try next command

Ans - next - it will show program is not being run but if the program runs then output will be

```
(gdb) run
Starting program: C:\Users\Admin\Desktop\Assignments\assign3/test.exe
[New Thread 9964.0x31bc]
[New Thread 9964.0x2250]

Breakpoint 1, main () at e.c:49
49              step_state(events_arr[cntr]);
(gdb) next
50              cntr++;
```

    c. How will you get inside the function without using breakpoint?

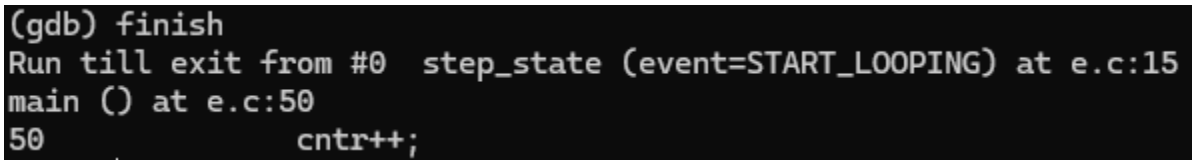
Ans - run, step

```
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: C:\Users\Admin\Desktop\Assignments\assign3/test.exe
[New Thread 6120.0x100c]
[New Thread 6120.0x3a24]

Breakpoint 1, main () at e.c:49
49              step_state(events_arr[cntr]);
(gdb) step
step_state (event=START_LOOPING) at e.c:15
15          switch(state) {
```

d. How will you come out the of the function without using next and continue?

Ans - finish



The program code is as follows:

```
/*******************************************************************************
*

Welcome to GDB Online.
GDB online is an online compiler and debugger tool for C, C++, Python, PHP, Ruby,
C#, VB, Perl, Swift, Prolog, Javascript, Pascal, HTML, CSS, JS
Code, Compile, Run and Debug online from anywhere in world.

*******************************************************************************
*/
#include <stdio.h>
#include <stdlib.h>
#include <stdio.h>
#include <stdlib.h>
enum states {
   START,
   LOOP,
   END,
} state;

enum events {
   START_LOOPING,
   USERID_MATCHED,
   SHOW_DETAIL,
   STOP_LOOPING,
};

int valid_id(int id)
{
        if ( id > 0 && id < 20)
                return 1;
        else
                return 0;
}
```

```
int valid_pw(int id, int password)
{

        if (password == id*1000)
                return 1;
        return 0;
}
int show(int id)
{
  return id*100000;
}
void step_state(enum events event) {
  int cntr= 0;
while(1) {
            int id , password;
            cntr++;
  switch(state) {
  case START:
    switch(event) {
    case START_LOOPING:
        {
      state = LOOP;
      if (cntr > 10) {
        printf("Session expired!");
        event = STOP_LOOPING;
        state = END;
            } else {
        printf("Hello Please Provide  User Id and Password to see your details!\n");
              printf("User Id: ");
              scanf("%d", &id);
              if (valid_id(id)) {
                      event = USERID_MATCHED ;
              } else {
                      printf("Incorrect User Id!!");
                      event = START_LOOPING ;
```

```
                        state = START ;
                    }
                }

            break;
            }
            case STOP_LOOPING:
            {
                printf("Invaid state\n");
                break;
            }
        default:
            exit(1);
            break;
        }
        break;
    case LOOP:
        switch(event) {
        case USERID_MATCHED:
                printf("Password: ");
                scanf("%d", &password);
                if (valid_pw(id,password)) {
                        event = SHOW_DETAIL ;
                } else {
                        printf("Incorrect password!!\n");
                        event = STOP_LOOPING ;
                        state = START ;
                }
            break;
        case SHOW_DETAIL:
                {
                        char c = 'p';
                printf("User Id : %d, Password: %d , Amount : %d\n", id,password,show(id));
                state = START ;
                event = START_LOOPING;
```

```
            }
          break;
        default:
          exit(1);
          break;
        }
        break;
    case END:
        exit(1);
        break;
    }
}
}
int main(void) {
    step_state(START_LOOPING);

    return 0;
}
```

2. Consider the program in Assign4 .It is also a simple state machine.If you provide user id and password properly account details will be displayed. The basic rule is user id should be positive and less than 20 .password is userid *b1000 .The loop will terminate after 10 iteration. It works fine if you provide valid user id and password.It works fine for invalid userid. But it goes to infiniteloop for invalid password.Run the program .It goes into infinite loop.you need to kill the program by [ctrl^c]

a. Set a suitable breakpoint in gdb in the routine show.give valid input and run :

Ans - break show

```
(gdb) break show
Breakpoint 1 at 0x40149f: file f.c, line 43.
```

b. How you can see the call stack of the routine.

Ans - first run the program then , info stack and the we use backtrace to call stack of the routine.

run, info stack, backtrace

```
(gdb) run
Starting program: C:\Users\Admin\Desktop\Assignments\assign4/prog.exe
[New Thread 14720.0x6b8]
[New Thread 14720.0x2ffc]
Hello Please Provide  User Id and Password to see your details!
User Id: 13
Password: 13000

Breakpoint 1, show (id=13) at f.c:43
43          return id*100000;
(gdb) info stack
#0  show (id=13) at f.c:43
#1  0x0040161f in step_state (event=SHOW_DETAIL) at f.c:101
#2  0x0040168b in main () at f.c:119
(gdb) backtrace
#0  show (id=13) at f.c:43
#1  0x0040161f in step_state (event=SHOW_DETAIL) at f.c:101
#2  0x0040168b in main () at f.c:119
```

c. Which commands will help you to see each value change of variable “event”?

Ans - first run the program , then use the step command and use the watch event command to see the number of hardware watchpoints.

run, step,watch event,step, watch event, step, watch event, step , watch event.

```
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
error return ../../gdb-7.6.1/gdb/windows-nat.c:1275 was 5
Starting program: C:\Users\Admin\Desktop\Assignments\assign4/prog.exe
[New Thread 3696.0x830]
[New Thread 3696.0x720]
Hello Please Provide  User Id and Password to see your details!
User Id: 6
Password: 6000

Breakpoint 1, show (id=6) at f.c:43
43          return id*100000;
(gdb) step
44      }
(gdb) watch event
No symbol "event" in current context.
(gdb) step
User Id : 6, Password: 6000 , Amount : 600000
step_state (event=SHOW_DETAIL) at f.c:102
102                 state = START ;
(gdb) watch event
Hardware watchpoint 2: event
(gdb) step
103                 event = START_LOOPING;
(gdb) watch event
Hardware watchpoint 3: event
(gdb) step
Hardware watchpoint 2: event

Old value = SHOW_DETAIL
New value = START_LOOPING
Hardware watchpoint 3: event

Old value = SHOW_DETAIL
New value = START_LOOPING
step_state (event=START_LOOPING) at f.c:106
106                 break;
(gdb) watch event
Hardware watchpoint 4: event
```

d. Correct the program so that it doesn't go to infinite loop for wrong password. Rather main iteration restarts . [follow the value change path of event for wrong password]

Ans - Just change the STOP_LOOPING to START_LOOPING

in the USERID SECTION, then it will not go to infinite looping.

BEFORE:

```
case LOOP:
    switch(event) {
    case USERID_MATCHED:
    printf("Password: ");
    scanf("%d", &password);
    if (valid_pw(id,password)) {
        event = SHOW_DETAIL ;
    } else {
        printf("Incorrect password!!\n");
        event = STOP_LOOPING ;
        state = START ;
    }
        break;
```

AFTER:

```
case LOOP:
    switch(event) {
    case USERID_MATCHED:
    printf("Password: ");
    scanf("%d", &password);
    if (valid_pw(id,password)) {
        event = SHOW_DETAIL ;
    } else {
        printf("Incorrect password!!\n");
        event = START_LOOPING ;
        state = START ;
    }
        break;
```

Explore the commands found for 5c to see/use content of a pointer

Ans - x <funtion_name or variable_name>

example -

x show