```
#include <stdio.h>
#define MAX_TEMP (70.0)
#define MIN_TEMP (66.0)
#define CHATTER_LIMIT (2)

#define NO_HEAT 1
#define NORMAL_HEAT 2
#define FAST_HEAT 3

int controller(double room_temp){
	static int on_ctr, off_ctr, chatter_detect_ctr;
	static int previous_command, command, u;

	if (room_temp >= MIN_TEMP && room_temp < MAX_TEMP)
		command = NORMAL_HEAT;
	else if (room_temp >= MAX_TEMP)
		command = NO_HEAT;
	else if (room_temp < MIN_TEMP)
		command = FAST_HEAT;
	else
		command = previous_command;

	if (off_ctr >= 5 || on_ctr >= 5)
		chatter_detect_ctr=0;

	if (command != previous_command)
		chatter_detect_ctr++;

	if (chatter_detect_ctr > CHATTER_LIMIT)
		command = previous_command;

	if (command == NO_HEAT){
		on_ctr=0;
		off_ctr++;
	} else {
		on_ctr++;
		off_ctr=0;
	}

	if (command==NO_HEAT)
		u = 20;
	if (command==FAST_HEAT)
		u = 100;
	if (command==NORMAL_HEAT)
		u = 70;

	return u;
}
```

========== End of the Controller Program ==========

```
/*----Control Variables-------SSA/SMT Variables ------------*/
/*--------------------------------------------------------*/
            on_ctr
            off_ctr
            chatter_ctr
            cmd                         cmd_k_i
            u
/*----State Variables-------SSA/SMT Variables ------------*/
/*--------------------------------------------------------*/
            room_temp
/*------------------- Part - 1 ------------------------*/
/*------------ of Original Control Program -----------*/

if(room_temp >= MED_TEMP && room_temp < MAX_TEMP)
   command_to_heater = 2;
else if(room_temp >= MAX_TEMP)
   command_to_heater = 0;
else if(room_temp < MED_TEMP)
     command_to_heater = 1;
else
   command_to_heater = previous_command_to_heater;

/*------------------- SSA Conversion of Original Control Program ------------*/

command_to_heater_0_1 = (room_temp_0_t >= MED_TEMP && room_temp_0_t < MAX_TEMP) ?
                        2 : ( (room_temp_0_t >= MAX_TEMP) ?
                        0 : ( (room_temp_0_t < MED_TEMP) ?
                        1 : command_to_heater_0_0) )
/*------------------- SMT Conversion-----------*/

(ite (and (>= room_temp_0_t 66.00) (< room_temp_0_t 70.00)) (= command_to_heater_0_1 2)
 ((ite (>= room_temp_0_t 70.00) (= command_to_heater_0_1 0)
 ((ite (< room_temp_0_t 66.00) (= command_to_heater_0_1 1)
 (= command_to_heater_0_1 command_to_heater_0_0))))))
/*--------------------------------------------------------*/

/*------------------- Part - 2 ------------------------*/
/*------------ of Original Control Program -----------*/

if(off_counter >= 5 || on_counter >= 5)
   chatter_detect = 0;

if(command_to_heater != previous_command_to_heater)
   chatter_detect++;

if(chatter_detect > chatter_limit)
   command_to_heater = previous_command_to_heater;

/*------------------- SSA Conversion of Original Control Program ----------------*/

chatter_detect_0_1 =        (off_counter_0_0 >= 5 || on_counter_0_0 >= 5) ?
                            0 : chatter_detect_0_0

chatter_detect_0_2 =        (command_to_heater_0_1 != command_to_heater_0_0) ?
                            (chatter_detect_0_1 + 1) : chatter_detect_0_1

command_to_heater_0_2 = (chatter_detect_0_2 > chatter_limit) ?
                            command_to_heater_0_0 : command_to_heater_0_1
/*--------------------------------------------------------*/
/*------------------- SMT Conversion ----------------*/
(ite (or (>= off_counter_0_0 5) (>= on_counter_0_0 5)
 (= chatter_detect_0_1 0)
 (= chatter_detect_0_1 chatter_detect_0_0)))
```

```
(ite (or (> command_to_heater_0_1 command_to_heater_0_0)
 (< command_to_heater_0_1 command_to_heater_0_0))
 (= chatter_detect_0_2 (chatter_detect_0_1 + 1) )
 (= chatter_detect_0_2 chatter_detect_0_1 ) )

(ite (> chatter_detect_0_2 2)
 (= command_to_heater_0_2 command_to_heater_0_0)
 (= command_to_heater_0_2 command_to_heater_0_1))
/*-------------------------------------------------------*/

/*-------------------- Part - 3 ------------------------*/
/*------------ of Original Control Program ------------*/
if(command_to_heater == 0)
  {
    on_counter = 0;
    off_counter++;
  }
  else
  {
    on_counter++;
    off_counter = 0;
}
/*------------------- SSA Conversion of Original Control Program ------------------*/
on_counter_0_1 = (command_to_heater_0_2 == 0) ?
                          0 : (on_counter_0_0 + 1)

off_counter_0_1 = (command_to_heater_0_2 == 0) ?
                           (off_counter_0_0 + 1) : 0
/*------------------- SMT Conversion ------------------------*/
(ite (= command_to_heater_0_2 0)
 (and (= on_counter_0_1 0)
 (= off_counter_0_1 (+ off_counter_0_0 1)))
 (and (= on_counter_0_1 (+ on_counter_0_0 1))
 (= off_counter_0_1 0)))

/*-------------------- Part - 4 ------------------------*/
/*------------ of Original Control Program ------------*/
if(command_to_heater == No_Heat)                    u = 20;
else if(command_to_heater == Fast_Heat)             u = 100;
else if(command_to_heater == Normal_Heat)           u = 70;
else        u = u; //No change
/*-------------------------------------------------------*/
/*------------------- SSA Conversion of Original Control Program ------------------*/
u_0_1 = (command_to_heater_0_2 == 0) ?
            20 : ((command_to_heater_0_2 == 1) ?
            100 : (command_to_heater_0_2 == 2) ?
            70 : u_0_0 )
/*------------------- SMT Conversion -----------------*/
(ite (= command_to_heater_0_2 0)
 (= u_0_1 20)
 (ite (= command_to_heater_0_2 1)
 (= u_0_1 100)
 (ite (= command_to_heater_0_2 2)
 (= u_0_1 70)
 (= u_0_1 u_0_0))))
 /*------------------- SMT Assignments ------------------------*/
(= command_to_heater_1_0 command_to_heater_0_2) (= off_counter_1_0 off_counter_0_1) (= on_counter_1_0
on_counter_0_1) (= u_1_0 u_0_1)
 /*-------------------------------------------------------*/
```