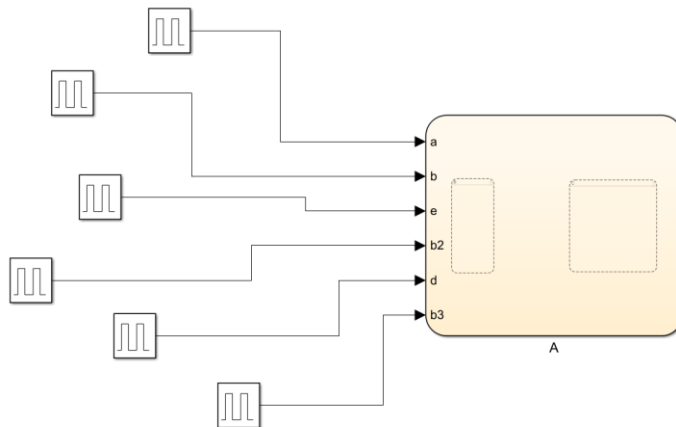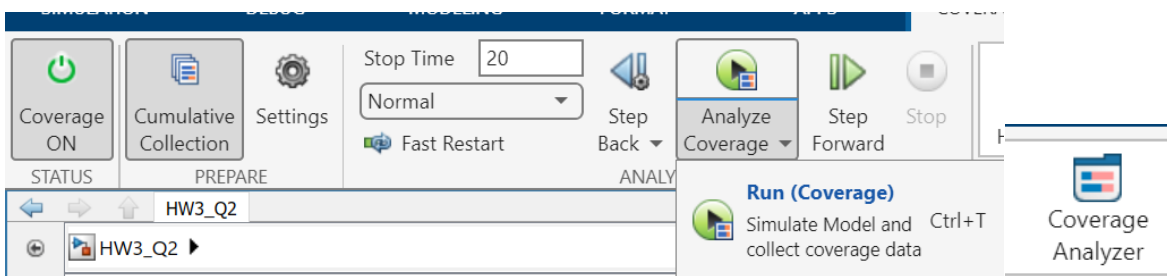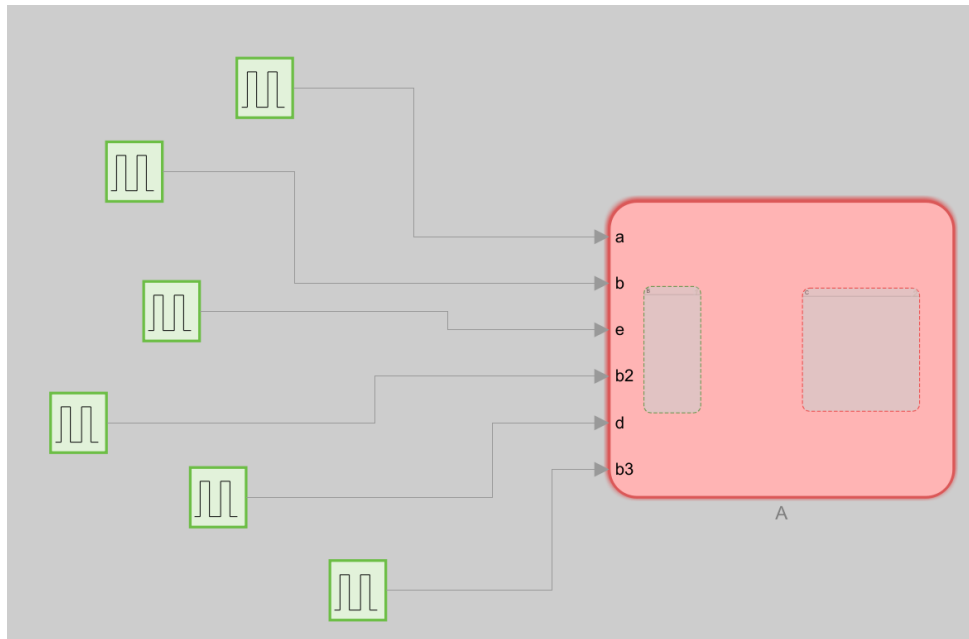الف)

برای سوال سوم از مدلی که در تمرین شماره 3 پیاده سازی کردیم استفاده میکنیم که مدل آن به
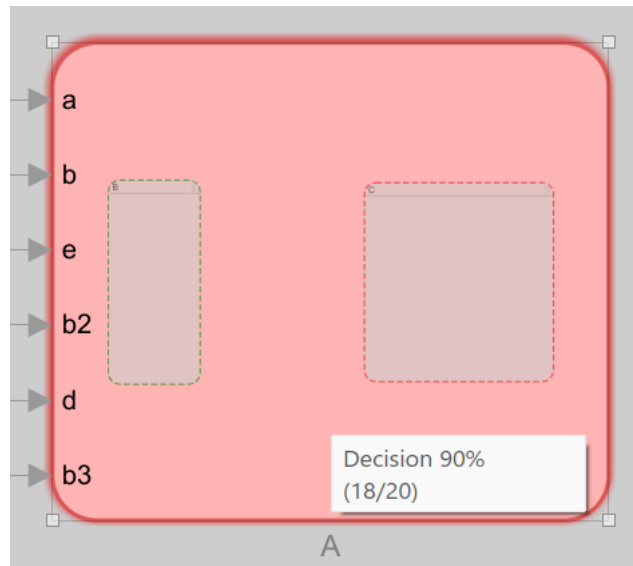صورت زیر است :

در قسمت APPS با برنامه Coverage analyzer مدل خودمون رو انالیز میکنیم :

بعد از ران گرفتن مدل به شکل زیر درمیاید :

که وقتی روی قسمت قرمز ماوس را نگه میداریم به ما درصد coverage را میدهد که در اینجا
18/20 است که میشود 90% :

و همچنین در بخش coverage details تمامی اطلاعات به صورت زیر آمده اند :

Coverage Report for HW3_Q2

Table of Contents

Analysis Information

Coverage Data Information

Collected in version	(R2022a)

Model Information

Model version	1.0
Author	Erfan
Last saved	Fri Apr 21 22:04:07 2023

Simulation Optimization Options

Default parameter behavior	tunable
Block reduction	forced off
Conditional branch optimization	on

Coverage Options

Analyzed model	HW3_Q2
Logic block short circuiting	off

Tests

Test	Started execution	Ended execution
Run 1	06-Jun-2023 04:49:32	06-Jun-2023 04:49:35

Summary

		Decision	Execution
1. HW3_Q2	15	90%	100%
2.... A	14	90%	NA
3....... SF' A	13	90%	NA
4.......... SF' B	6	100%	NA
5.......... SF' C	7	86%	NA
6............. SF: D	4	75%	NA

Details

1. Model "HW3_Q2"

Child Systems: A

Metric	Coverage (this object)	Coverage (inc. descendants)
Cyclomatic Complexity	1	15
Decision	NA	90% (18/20) decision outcomes
Execution	NA	100% (6/6) objective outcomes

Full Coverage

Model **Object**		Metric
DiscretePulseGenerator	block "Pulse_Generator"	Execution
DiscretePulseGenerator	block "Pulse_Generator1"	Execution
DiscretePulseGenerator	block "Pulse_Generator2"	Execution
DiscretePulseGenerator	block "Pulse_Generator3"	Execution
DiscretePulseGenerator	block "Pulse_Generator4"	Execution
DiscretePulseGenerator	block "Pulse_Generator5"	Execution

2. SubSystem block "A"

Justify or Exclude

Parent: /HW3_Q2
Child Systems: A

Metric	Coverage (this **object**)	Coverage (inc. descendants)
Cyclomatic Complexity	1	14
Decision	NA	90% (18/20) decision outcomes

3. Chart "A"

Parent: HW3_Q2/A

Child Systems: B, C

Metric	Coverage (this object)	Coverage (inc. descendants)
Cyclomatic Complexity	0	13
Decision	NA	90% (18/20) decision outcomes

4. State "B"

Parent: HW3_Q2/A

Metric	Coverage (this object)	Coverage (inc. descendants)
Cyclomatic Complexity	1	6
Decision	100% (2/2) decision outcomes	100% (6/6) decision outcomes

Decisions analyzed

Substate executed	100%
State "State_1"	15/20
State "State_2"	5/20

Full Coverage

Model Object	Metric
Transition "[c]" from "State_1" to "State_2"	Decision
Transition "[(b |b2 b3) && in(C.D.D2)]" from "State_2" to "State_1"	Decision

5. State "C"

Parent: HW3_Q2/A

Child Systems: D

Metric	Coverage (this object)	Coverage (inc. descendants)

| Cyclomatic Complexity | 1 | 7 |
| Decision | 100% (2/2) decision outcomes | 86% (12/14) decision outcomes |

Decisions analyzed

Substate executed		100%
State "D"		8/20
State "G"		12/20

Full Coverage

Model Object	Metric
Transition "[d]" from "D" to "G"	Decision
Transition "[a](c = l;}" from "G" to "D"	Decision

6. State "D"

Justify or Exclude

Parent: HW3_Q2/A.C

Uncovered Links: ➡

Metric	Coverage (this object)	Coverage (inc. descendants)
Cyclomatic Complexity	2	4
Decision	75% (3/4) decision outcomes	75% (6/8) decision outcomes

Decisions analyzed

Substate executed		100%
State "D1"		4/7
State "D2"		3/7
Substate exited when parent exits		50%
State "D1"		🔲
State "D2"		1/1

Transition " [e]" from "D2" to "D2"

Justify or Exclude

Parent: HW3_Q2/A.C.D

Uncovered Links: ⬅

Metric	Coverage
Cyclomatic Complexity	1
Decision	50% (1/2) decision outcomes

```
1 [e]
```

#1: [e]

Decisions analyzed

e	50%
false	3/3
true	0/3

Full Coverage

Model Object	Metric
Transition "[e] {c = 0;}" from "D1" to "D2"	Decision

ب)

SLOC :

language	files	code	comment	blank	total
C	1	113	49	32	194

Global :

```
#define HW3_Q2_IN_D                  ((uint8_T)1U)
#define HW3_Q2_IN_D1                 ((uint8_T)1U)
#define HW3_Q2_IN_D2                 ((uint8_T)2U)
#define HW3_Q2_IN_G                  ((uint8_T)2U)
#define HW3_Q2_IN_NO_ACTIVE_CHILD    ((uint8_T)0U)
#define HW3_Q2_IN_State_1            ((uint8_T)1U)
#define HW3_Q2_IN_State_2            ((uint8_T)2U)
```

SCC :

تعداد شروط منطقی 30 تا است که بعلاوه 1 میشود 31.

SF = 31 + 7*5 + (113/20) = 31 + 35 + 5.65 = 71.65

ج)

ابتدا برای کد generate شده به صورت زیر test مینویسیم :

```c
void set_pulse_sequence(double a, double b, double e, double b2,double d, double b3) {
    Pulses.a_Amp = a;
    Pulses.b_Amp = b;
    Pulses.e_Amp = e;
    Pulses.b2_Amp = b2;
    Pulses.d_Amp = d;
    Pulses.b3_Amp = b3;
}
void test_HW3_Q2_step_initial(void) {
    // Initialize the model
    HW3_Q2_initialize();

    // Call the step function
    HW3_Q2_step();

    // Check the initial conditions
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_G, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_NO_ACTIVE_CHILD, HW3_Q2_DW.is_D);
}

void test_HW3_Q2_step_a(void) {
    // Set pulse a
    set_pulse_sequence(1.0, 0.0, 0.0, 0.0, 0.0, 0.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}
void test_HW3_Q2_step_b(void) {
    // Set pulse a
    set_pulse_sequence(0.0, 1.0, 0.0, 0.0, 0.0, 0.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
```

```c
        TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}
void test_HW3_Q2_step_e(void) {
    // Set pulse a
    set_pulse_sequence(0.0, 0.0, 1.0, 0.0, 0.0, 0.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}
void test_HW3_Q2_step_b2(void) {
    // Set pulse a
    set_pulse_sequence(0.0, 0.0, 0.0, 1.0, 0.0, 0.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}
void test_HW3_Q2_step_d(void) {
    // Set pulse a
    set_pulse_sequence(0.0, 0.0, 0.0, 0.0, 1.0, 0.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}
void test_HW3_Q2_step_b3(void) {
    // Set pulse a
    set_pulse_sequence(0.0, 0.0, 0.0, 0.0, 0.0, 1.0);

    // Call the step function
    HW3_Q2_step();

    // Check the conditions for pulse a
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_State_1, HW3_Q2_DW.is_B);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D, HW3_Q2_DW.is_C);
    TEST_ASSERT_EQUAL_UINT8(HW3_Q2_IN_D1, HW3_Q2_DW.is_D);
}

int main(void) {
```

```
    UNITY_BEGIN();

    // Initial
    RUN_TEST(test_HW3_Q2_step_initial);

    // Pulse a
    RUN_TEST(test_HW3_Q2_step_a);

    // Pulse b
    RUN_TEST(test_HW3_Q2_step_b);

    // Pulse e
    RUN_TEST(test_HW3_Q2_step_e);

    // Pulse b2
    RUN_TEST(test_HW3_Q2_step_b2);

    // Pulse d
    RUN_TEST(test_HW3_Q2_step_d);

    // Pulse b3
    RUN_TEST(test_HW3_Q2_step_b3);

    return UNITY_END();
}
```

سپس در مرحله بعدی build گرفته و فایل platform.ini را برای وصل شدن به بورد modify میکنیم و unity را به پروژه اد میکنیم :

```
; PlatformIO Project Configuration File
;
;   Build options: build flags, source filter
;   Upload options: custom upload port, speed and extra flags
;   Library options: dependencies, extra library storages
;   Advanced options: extra scripting
;
; Please visit documentation for the other options and examples
; https://docs.platformio.org/page/projectconf.html

[env:megaatmega2560]
platform = atmelavr
board = megaatmega2560
framework = arduino
lib_deps = throwtheswitch/Unity@^2.5.2
upload_port = /dev/ttyACM2
test_port = /dev/ttyACM2
```

سپس در مرحله بعدی با دستور ترمینال به بورد وصل میشویم :

در مرحله بعدی به بوردی که وصل شدیم تست میگیریم :

```
D:\Telegram\Embedded Systems\HW8\Q3\HW8>pio remote test
Building project locally
Verbosity level can be increased via `-v, -vv, or -vvv` option
Collected 1 tests
```

و در ادامه success میشود :

در ادامه بورد ما timeout داد و نتوانستیم وصل شویم(10 بار امتحان کردیم و نتیجه نداد).

```
--------------------------------------------------------------------------------
Building & Uploading...
avrdude: ser_open(): can't open device "/dev/ttyACM3": The system cannot find the path specified.


avrdude: ser_drain(): read error: The handle is invalid.


avrdude: ser_send(): write error: sorry no info avail
avrdude: stk500_send(): failed to send command to serial port
avrdude: ser_recv(): read error: The handle is invalid.


avrdude: stk500v2_ReceiveMessage(): timeout
avrdude: ser_send(): write error: sorry no info avail
avrdude: stk500_send(): failed to send command to serial port
avrdude: ser_recv(): read error: The handle is invalid.


avrdude: stk500v2_ReceiveMessage(): timeout
avrdude: ser_send(): write error: sorry no info avail
avrdude: stk500_send(): failed to send command to serial port
avrdude: ser_recv(): read error: The handle is invalid.


avrdude: stk500v2_ReceiveMessage(): timeout
avrdude: ser_send(): write error: sorry no info avail
avrdude: stk500_send(): failed to send command to serial port
avrdude: ser_recv(): read error: The handle is invalid.


avrdude: stk500v2_ReceiveMessage(): timeout
avrdude: ser_send(): write error: sorry no info avail
avrdude: stk500_send(): failed to send command to serial port
avrdude: ser_recv(): read error: The handle is invalid.

 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: ser_send(): write error: sorry no info avail
 megaatmega2560  *         ERRORED    00:00:00.820
 ================== 1 test cases: 0 succeeded in 00:00:00.820 ==================
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_ReceiveMessage(): timeout
 avrdude: stk500v2_getsync(): timeout communicating with programmer

 avrdude done.  Thank you.

 *** [upload] Error 1
 Uploading stage has failed, see errors above. Use `pio test -vvv` option to enable verbose output.
 ---------------- megaatmega2560:* [ERRORED] Took 30.87 seconds ----------------


 ================================== SUMMARY ==================================
 Environment     Test    Status    Duration
 -------------   ------  --------  -----------
 megaatmega2560  *         ERRORED    00:00:30.867
 ================== 1 test cases: 0 succeeded in 00:00:30.867 ==================
```