

بخش اول:

فرمت گرفتن ورودی به این شکل است: مثلاً با ورودی $A=[a1,a2,a3]-B=[b1,b2]-C=[c1]$ یعنی Characteristics های ما شامل A,B,C میباشد و Abstract blocks شامل $A=[a1,a2,a3]$ و $B=[b1,b2]$ و $C=[c1]$ است.

در قدم بعدی انواع مدکاری از کاربر پرسیده میشود که اگر ورودی کاربر BCC یا MBCC باشد در خط بعدی باید Base یا Base ها به فرمت مثلاً $A=a1,A=a2,B=b1,C=c1$ باشد که بدین معنی است که بیس های ما مثلاً $(a1, b1, c1)$ و $(a2,b1,c1)$ است.

تست کیس ها :

مود ACoC:

با ورودی : $A=[a1,a2]-B=[b1,b2]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2]-B=[b1,b2]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ACoC
Generated blocks:
('a1', 'b1')
('a1', 'b2')
('a2', 'b1')
('a2', 'b2')

Process finished with exit code 0
```

با ورودی : $A=[a1,a2,a3]-B=[b1,b2]-C=[c1]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3]-B=[b1,b2]-C=[c1]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ACoC
Generated blocks:
('a1', 'b1', 'c1')
('a1', 'b2', 'c1')
('a2', 'b1', 'c1')
('a2', 'b2', 'c1')
('a3', 'b1', 'c1')
('a3', 'b2', 'c1')

Process finished with exit code 0
```

با ورودی:

$A=[a_1,a_2,a_3,a_4,a_5]-B=[b_1,b_2,b_3,b_4,b_5]-C=[c_1,c_2,c_3,c_4,c_5]-D=[d_1,d_2,d_3,d_4,d_5]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ACoC
Generated blocks:
('a1', 'b1', 'c1', 'd1')
('a1', 'b1', 'c1', 'd2')
('a1', 'b1', 'c1', 'd3')
('a1', 'b1', 'c1', 'd4')
('a1', 'b1', 'c1', 'd5')
('a1', 'b1', 'c2', 'd1')
('a1', 'b1', 'c2', 'd2')
('a1', 'b1', 'c2', 'd3')
('a1', 'b1', 'c2', 'd4')
('a1', 'b1', 'c2', 'd5')
('a1', 'b1', 'c3', 'd1')
('a1', 'b1', 'c3', 'd2')
('a1', 'b1', 'c3', 'd3')
('a1', 'b1', 'c3', 'd4')
('a1', 'b1', 'c3', 'd5')
('a1', 'b1', 'c4', 'd1')
('a1', 'b1', 'c4', 'd2')
('a1', 'b1', 'c4', 'd3')
('a1', 'b1', 'c4', 'd4')
```

به علت تعداد زیاد خروجی فقط صفحه اول نمایش داده شده است.

مود ECC:

با ورودی : $A=[a1,a2]-B=[b1,b2]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2]-B=[b1,b2]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ECC
Generated blocks:
('a1', 'b1')
('a2', 'b2')

Process finished with exit code 0
```

با ورودی : $A=[a1,a2,a3]-B=[b1,b2]-C=[c1]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3]-B=[b1,b2]-C=[c1]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ECC
Generated blocks:
('a1', 'b1', 'c1')
('a2', 'b2', 'c1')
('a3', 'b1', 'c1')

Process finished with exit code 0
```

با ورودی:

$A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]
Enter the mode of work (BCC, ECC, ACoC, MBCC): ECC
Generated blocks:
('a1', 'b1', 'c1', 'd1')
('a2', 'b2', 'c2', 'd2')
('a3', 'b3', 'c3', 'd3')
('a4', 'b4', 'c4', 'd4')
('a5', 'b5', 'c5', 'd5')

Process finished with exit code 0
```

مود BCC:

با ورودی : $A=[a1,a2]-B=[b1,b2]$

با بیس: $A=a1,B=b1$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2]-B=[b1,b2]
Enter the mode of work (BCC, ECC, ACoC, MBCC): BCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a1,B=b1
Generated blocks:
('a1', 'b1')
('a2', 'b1')
('a1', 'b2')

Process finished with exit code 0
```

با ورودی: $A=[a1,a2,a3]-B=[b1,b2]-C=[c1]$

با بیس: $A=a2,B=b2,C=c1$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3]-B=[b1,b2]-C=[c1]
Enter the mode of work (BCC, ECC, ACoC, MBCC): BCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a2,B=b2,C=c1
Generated blocks:
('a2', 'b2', 'c1')
('a1', 'b2', 'c1')
('a3', 'b2', 'c1')
('a2', 'b1', 'c1')

Process finished with exit code 0
```

با ورودی:

$A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]$

با بیس: $A=a3,B=b4,C=c5,D=d1$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]
Enter the mode of work (BCC, ECC, ACoC, MBCC): BCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a3,B=b4,C=c5,D=d1
Generated blocks:
('a3', 'b4', 'c5', 'd1')
('a1', 'b4', 'c5', 'd1')
('a2', 'b4', 'c5', 'd1')
('a4', 'b4', 'c5', 'd1')
('a5', 'b4', 'c5', 'd1')
('a3', 'b1', 'c5', 'd1')
('a3', 'b2', 'c5', 'd1')
('a3', 'b3', 'c5', 'd1')
('a3', 'b5', 'c5', 'd1')
('a3', 'b4', 'c1', 'd1')
('a3', 'b4', 'c2', 'd1')
('a3', 'b4', 'c3', 'd1')
('a3', 'b4', 'c4', 'd1')
('a3', 'b4', 'c5', 'd2')
('a3', 'b4', 'c5', 'd3')
('a3', 'b4', 'c5', 'd4')
('a3', 'b4', 'c5', 'd5')
```

مود MBCC:

با ورودی : $A=[a1,a2]-B=[b1,b2]$

با بیس های: $A=a1,A=a2,B=b1,B=b2$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2]-B=[b1,b2]
Enter the mode of work (BCC, ECC, ACoC, MBCC): MBCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a1,A=a2,B=b1,B=b2
Generated blocks:
('a2', 'b2')
('a1', 'b2')
('a2', 'b1')

Process finished with exit code 0
```


با ورودی : $A=[a1,a2,a3]-B=[b1,b2]-C=[c1]$

با بیس های: $A=a1,A=a3,B=b2,C=c1$

خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3]-B=[b1,b2]-C=[c1]
Enter the mode of work (BCC, ECC, ACoC, MBCC): MBCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a1,A=a3,B=b2,C=c1
Generated blocks:
('a3', 'b2', 'c1')
('a1', 'b2', 'c1')
('a2', 'b2', 'c1')
('a3', 'b1', 'c1')

Process finished with exit code 0
```

با ورودی:

$A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]$

با بیس های: $A=a1,A=a2,B=b1,B=b2,C=c1,C=c2,D=d1,D=d2$

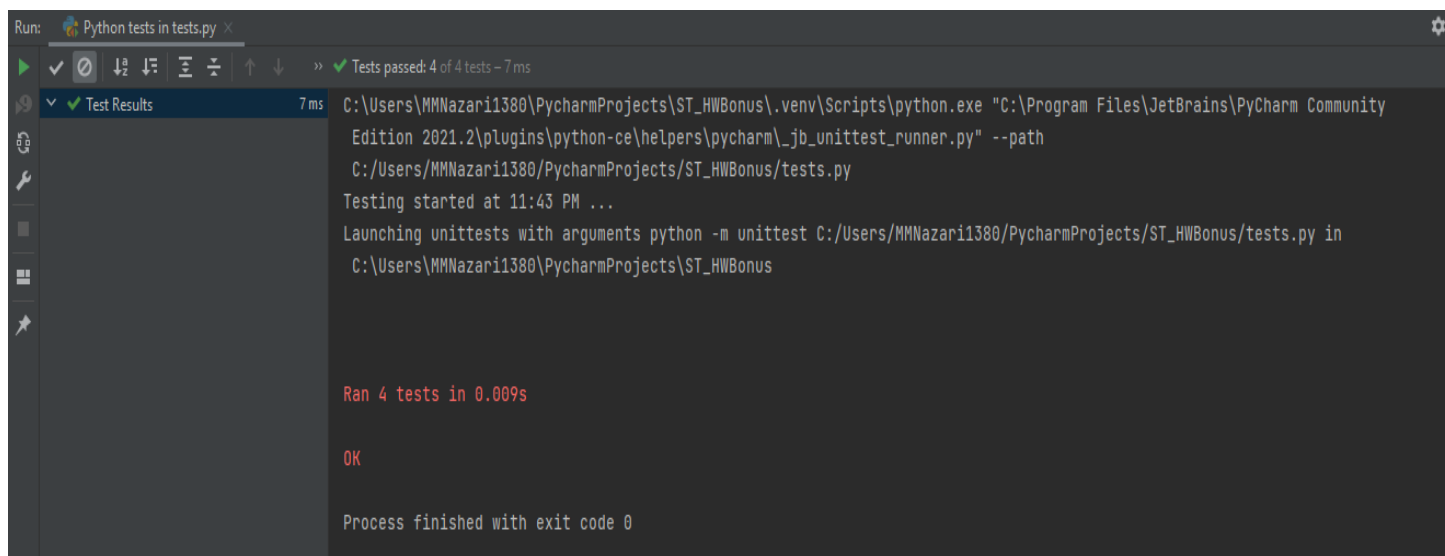
خروجی:

```
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\main.py
Enter characteristics and their abstract blocks (e.g., A=[a1,a2]-B=[b1]): A=[a1,a2,a3,a4,a5]-B=[b1,b2,b3,b4,b5]-C=[c1,c2,c3,c4,c5]-D=[d1,d2,d3,d4,d5]
Enter the mode of work (BCC, ECC, ACoC, MBCC): MBCC
Enter base choices (e.g., A=a1,a2, B=b1, C=c1,c2): A=a1,A=a2,B=b1,B=b2,C=c1,C=c2,D=d1,D=d2
Generated blocks:
('a2', 'b2', 'c2', 'd2')
('a1', 'b2', 'c2', 'd2')
('a3', 'b2', 'c2', 'd2')
('a4', 'b2', 'c2', 'd2')
('a5', 'b2', 'c2', 'd2')
('a2', 'b1', 'c2', 'd2')
('a2', 'b3', 'c2', 'd2')
('a2', 'b4', 'c2', 'd2')
('a2', 'b5', 'c2', 'd2')
('a2', 'b2', 'c1', 'd2')
('a2', 'b2', 'c3', 'd2')
('a2', 'b2', 'c4', 'd2')
('a2', 'b2', 'c5', 'd2')
('a2', 'b2', 'c2', 'd1')
('a2', 'b2', 'c2', 'd3')
('a2', 'b2', 'c2', 'd4')
('a2', 'b2', 'c2', 'd5')

Process finished with exit code 0
```

بخش دوم

برای این قسمت برای هر کدام از 4 مود کاری یک تست واحد با اولین حالت ورودی نوشته شده که در فایل tests.py قرار دارند.



The screenshot shows the PyCharm Run window for the file tests.py. The status bar at the top indicates "Tests passed: 4 of 4 tests - 7 ms". The "Test Results" tab is active, showing a list of 4 tests, all of which passed. The output pane on the right displays the command used to run the tests and the results.

```
Run: Python tests in tests.py x
>> Tests passed: 4 of 4 tests - 7 ms
Test Results 7 ms
C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\.venv\Scripts\python.exe "C:\Program Files\JetBrains\PyCharm Community Edition 2021.2\plugins\python-ce\helpers\pycharm\_jb_unittest_runner.py" --path C:/Users/MMNazari1380/PycharmProjects/ST_HWBonus/tests.py
Testing started at 11:43 PM ...
Launching unittests with arguments python -m unittest C:/Users/MMNazari1380/PycharmProjects/ST_HWBonus/tests.py in C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus

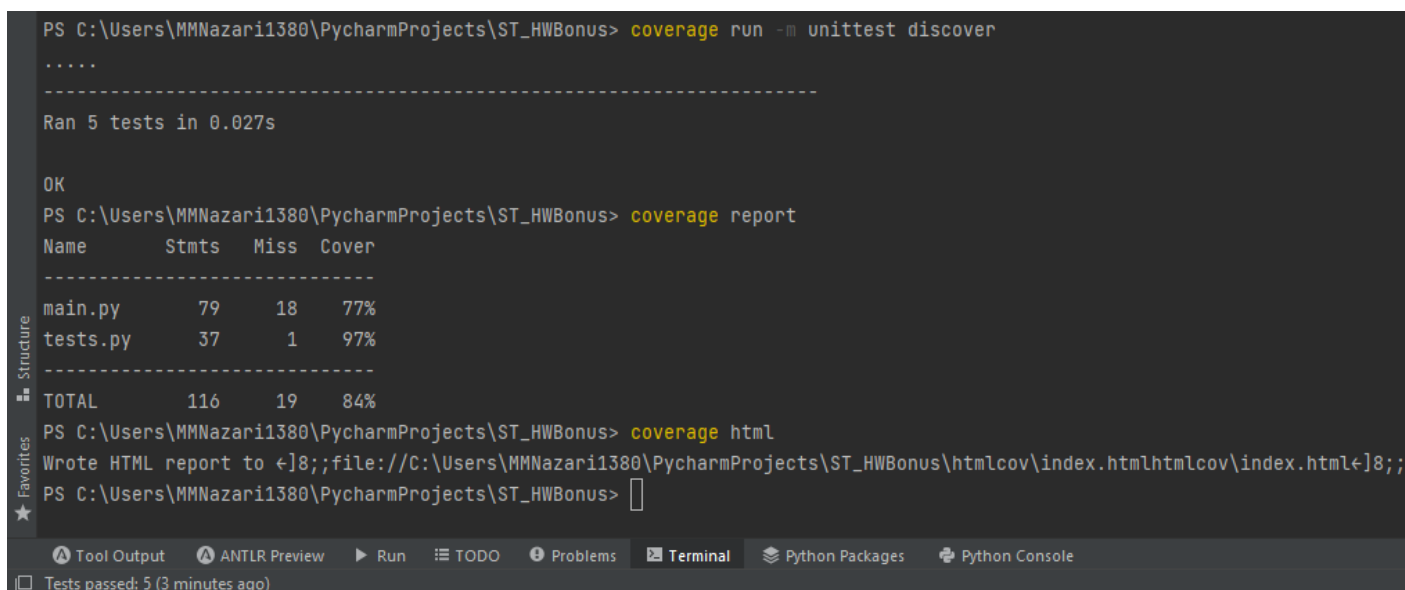
Ran 4 tests in 0.009s

OK

Process finished with exit code 0
```

یک تست واحد هم برای تابع main مینویسیم تا از جهت میزان پوشش کد به مشکل نخوریم.

برای بدست آوردن میزان پوشش کد از کتابخانه coverage استفاده میکنیم به شرح زیر :



The screenshot shows the PyCharm Terminal window with the following commands and output:

```
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus> coverage run -m unittest discover
.....
-----
Ran 5 tests in 0.027s

OK
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus> coverage report
Name      Stmts  Miss  Cover
-----
main.py    79     18   77%
tests.py   37      1   97%
-----
TOTAL     116     19   84%
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus> coverage html
Wrote HTML report to <[8];file:///C:/Users/MMNazari1380/PycharmProjects/ST_HWBonus/htmlcov/index.htmlhtmlcov/index.html[8];
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus>
```

The bottom of the terminal shows the status bar with "Tests passed: 5 (3 minutes ago)".

طبق گزارش بدست آمده 77 درصد کد برنامه اصلی توسط تست واحدها پوشش داده شده اند. جزییات پوشش کد در فایل html ساخته شده قابل مشاهده است.

بخش سوم

کد قسمت های feature و steps در دایرکتوری های هر کدام پیاده شده است. یک تست برای حالت ACoC و ورودی $A=[a1,a2]-B=[b1,b2]$ تست شده است با خروجی زیر :

```
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\features> behave BDD.feature
Feature: Generate Blocks # BDD.feature:1

  Scenario: ACoC mode with given characteristics # BDD.feature:3
    Given characteristics are "A=[a1,a2]-B=[b1,b2]" # steps/BDD_Steps.py:159
    And the mode is "ACoC" # steps/BDD_Steps.py:169
    Then generated blocks should be # steps/BDD_Steps.py:174
      |  |  |
      | a1 | b1 |
      | a1 | b2 |
      | a2 | b1 |
      | a2 | b2 |

1 feature passed, 0 failed, 0 skipped
1 scenario passed, 0 failed, 0 skipped
3 steps passed, 0 failed, 0 skipped, 0 undefined
Took 0m0.000s
PS C:\Users\MMNazari1380\PycharmProjects\ST_HWBonus\features> 
```