VLSI Testing and Design for Testability

Assignment 6

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a) 指令:

./atpg -bt [backtrack numbers] -output [output_file] [絕對路徑+circuit name]

Result:

表一、Generate test vectors for b17.bench

backtrack	patterns	fault coverage	CPU run time(s)	actual backtrack numbers
1	41647	55.00%	995.48	68413
10	72511	82.09%	1477.04	376982
100	83711	90.01%	1865.91	1821691
1000	86025	91.62%	4730.26	12664818
1200	86183	91.73%	5326.50	14822703

可發現 backtrack 數量上升，fault coverage 會上升，但耗時同時也會上升

```
[s110305504@cad podem]$ ./atpg -bt 1 -output b17_1_vector b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 41647
Total backtrack number = 68413
---------------------------------------
Total fault number = 142884
Detected fault number = 78584
Undetected fault number = 64300
Abort fault number = 63861
Redundant fault number = 439
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 78584
Equivalent undetected fault number = 64300
Equivalent abort fault number = 63861
Equivalent redundant fault number = 439
---------------------------------------
Fault Coverge = 55.00%
Equivalent FC = 55.00%
Fault Efficiency = 55.17%
---------------------------------------
total CPU time = 995.48
```

圖一、backtrack = 1 result

```
[s110305504@cad podem]$ ./atpg -bt 10 -output b17_1_vector b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 72511
Total backtrack number = 376982
---------------------------------------
Total fault number = 142884
Detected fault number = 117297
Undetected fault number = 25587
Abort fault number = 25080
Redundant fault number = 507
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 117297
Equivalent undetected fault number = 25587
Equivalent abort fault number = 25080
Equivalent redundant fault number = 507
---------------------------------------
Fault Coverge = 82.09%
Equivalent FC = 82.09%
Fault Efficiency = 82.38%
---------------------------------------
total CPU time = 1477.04
```

圖二、backtrack = 10 result

```
[s110305504@cad podem]$ ./atpg -bt 100 -output b17_100_vector b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 83711
Total backtrack number = 1821691
---------------------------------------
Total fault number = 142884
Detected fault number = 128608
Undetected fault number = 14276
Abort fault number = 13584
Redundant fault number = 692
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 128608
Equivalent undetected fault number = 14276
Equivalent abort fault number = 13584
Equivalent redundant fault number = 692
---------------------------------------
Fault Coverge = 90.01%
Equivalent FC = 90.01%
Fault Efficiency = 90.45%
---------------------------------------
total CPU time = 1865.91
```

圖三、backtrack = 100 result

```
[s110305504@cad podem]$ ./atpg -bt 1000 -output b17_1000_vector b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 86025
Total backtrack number = 12664818
---------------------------------------
Total fault number = 142884
Detected fault number = 130917
Undetected fault number = 11967
Abort fault number = 10933
Redundant fault number = 1034
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 130917
Equivalent undetected fault number = 11967
Equivalent abort fault number = 10933
Equivalent redundant fault number = 1034
---------------------------------------
Fault Coverge = 91.62%
Equivalent FC = 91.62%
Fault Efficiency = 92.29%
---------------------------------------
total CPU time = 4730.26
```

圖四、backtrack = 1000 result

```
[s110305504@cad podem]$ ./atpg -bt 1200 -output b17_1200_vector b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 86183
Total backtrack number = 14822703
---------------------------------------
Total fault number = 142884
Detected fault number = 131068
Undetected fault number = 11816
Abort fault number = 10705
Redundant fault number = 1111
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 131068
Equivalent undetected fault number = 11816
Equivalent abort fault number = 10705
Equivalent redundant fault number = 1111
---------------------------------------
Fault Coverge = 91.73%
Equivalent FC = 91.73%
Fault Efficiency = 92.45%
---------------------------------------
total CPU time = 5326.50
```

圖五、backtrack = 1200 result

b) 指令:

./atpg -check_point -output [pattern] [絕對路徑+circuit name]

./atpg -output [pattern] [絕對路徑+circuit name]

./atpg -fsim -input [pattern] [絕對路徑+circuit name]

表二、Result of different fault list for b17.bench

	Number of patterns	Fault coverage (atpg)	Fault coverage (fsim)
original	87963	93.00%	97.34%
checkpoint	53071	92.84%	97.28%

使用 checkpoint 可以維持差不多的 fault coverage，但 pattern 數量可以少很多

```
[s110305504@cad podem]$  ./atpg -output normal_b17 b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 87963
Total backtrack number = 95087176
---------------------------------------
Total fault number = 142884
Detected fault number = 132877
Undetected fault number = 10007
Abort fault number = 8378
Redundant fault number = 1629
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 132877
Equivalent undetected fault number = 10007
Equivalent abort fault number = 8378
Equivalent redundant fault number = 1629
---------------------------------------
Fault Coverge = 93.00%
Equivalent FC = 93.00%
Fault Efficiency = 94.07%
---------------------------------------
total CPU time = 28095.37
```

圖六、b17.bench original version atpg result

```
[s110305504@cad podem]$ ./atpg -fsim -input normal_b17 b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault simulation
---------------------------------------
Test pattern number = 87963
---------------------------------------
Total fault number = 142884
Detected fault number = 139083
Undetected fault number = 3801
---------------------------------------
Equivalent fault number = 142884
Equivalent detected fault number = 139083
Equivalent undetected fault number = 3801
---------------------------------------
Fault Coverge = 97.34%
Equivalent FC = 97.34%
---------------------------------------
total CPU time = 379.93
```

圖七、b17.bench original version fsim result

```
[s110305504@cad podem]$ ./atpg -check_point -output cp_b17 b17.bench
Start parsing input file
Finish reading circuit file
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 53071
Total backtrack number = 53126049
---------------------------------------
Total fault number = 81330
Detected fault number = 75504
Undetected fault number = 5826
Abort fault number = 4605
Redundant fault number = 1221
---------------------------------------
Total equivalent fault number = 81330
Equivalent detected fault number = 75504
Equivalent undetected fault number = 5826
Equivalent abort fault number = 4605
Equivalent redundant fault number = 1221
---------------------------------------
Fault Coverge = 92.84%
Equivalent FC = 92.84%
Fault Efficiency = 94.25%
---------------------------------------
total CPU time = 15904.51
```

圖八、b17.bench checkpoint atpg result

```
[s110305504@cad podem]$ ./atpg -fsim -input cp_b17 b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault simulation
---------------------------------------
Test pattern number = 53071
---------------------------------------
Total fault number = 142884
Detected fault number = 138999
Undetected fault number = 3885
---------------------------------------
Equivalent fault number = 142884
Equivalent detected fault number = 138999
Equivalent undetected fault number = 3885
---------------------------------------
Fault Coverge = 97.28%
Equivalent FC = 97.28%
---------------------------------------
total CPU time = 407.58
```

圖九、b17.bench checkpoint fsim result

c) 指令:

./atpg -hw6-c -output {pattern} [絕對路徑+circuit name]

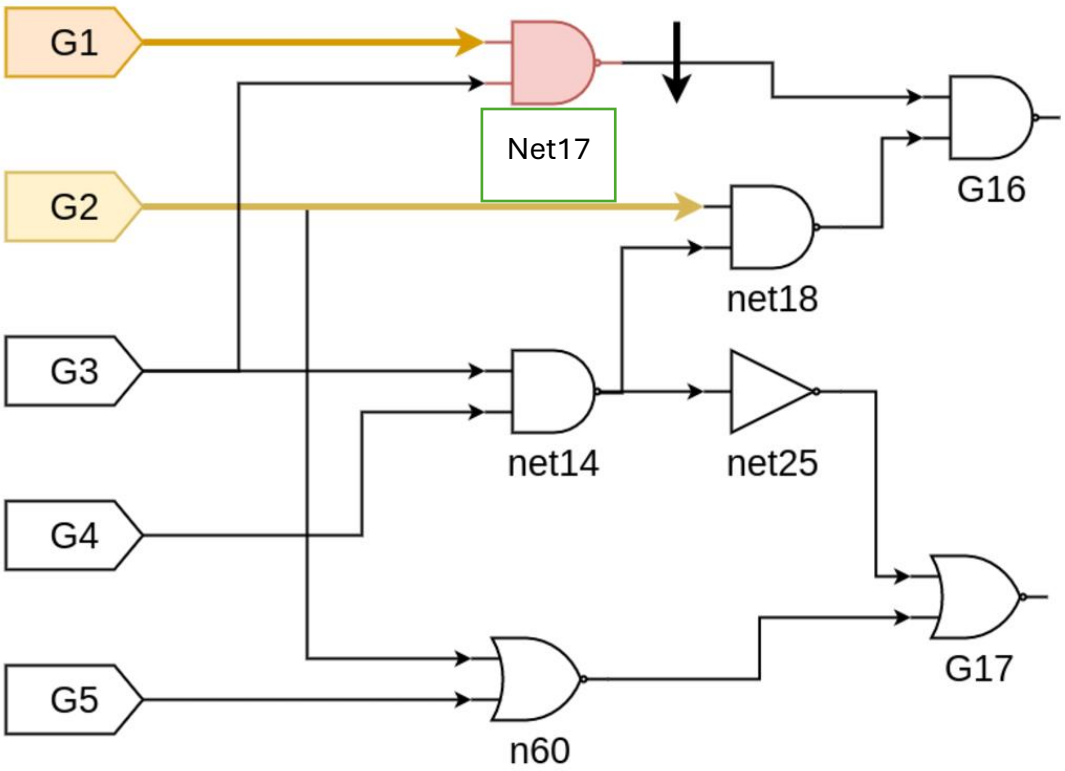
```
else if (option.retrieve("hw6-c")){
    int number1=0,number2=0;
    for(int i=0; i<Circuit.No_Gate(); i++) {
        if(Circuit.Gate(i)->GetName()=="n60") number1=i;
        else if (Circuit.Gate(i)->GetName()=="net17") number2=i;
    }
    // net17 stuck-at-0
    cout << "s-a-0 fault at " << Circuit.Gate(number2)->GetName() << endl;
    Circuit.setFault(Circuit.Gate(number2), Circuit.Gate(number2), S0);

    // n60 stuck-at-1
    cout << "s-a-1 fault at " << Circuit.Gate(number1)->GetName() << endl;
    Circuit.setFault(Circuit.Gate(number1), Circuit.Gate(number1), S1);

    //Circuit.GenerateAllFaultList();
    Circuit.SortFaninByLevel();
    Circuit.MarkOutputGate();
    Circuit.Atpg();


}
```

圖十、c 部分程式

在 main 中加入兩個 stuck at fault。

```
backwardImply returns 2
LET net17 to be 1
Backtrace
FindPIAssignment process returns G1 0
Forward Simulation:
Fault Activiation: let net17 to 1
Fault Propagation G16
LET G16 to be 0
Backtrace
FindPIAssignment process returns net18 1
FindPIAssignment process returns G2 0
Forward Simulation:
Fault has propagated to output
the result of ATPG before assign unknown values
--------------------
G1 0
G2 0
G3 X
G4 X
G5 X
--------------------
```

圖十一、net 17 s-a-0 result



圖十二、net 17 s-a-0 電路(參考網上範例圖)

1. **為了讓 net17 fault activation**
2. **backtrace G1 = 0**
3. **forward simulation -> net17 fault activation**
4. **fault propagation 到 G16**
5. **backtrace net 18 = 1**
6. **backtrace G2=0**
7. **forward simulation 驗證輸出故障是否觀察到。**

```
[s110305504@cad podem]$ ./atpg -hw6-c -output n60.txt "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas85/c17.bench"
Start parsing input file
Finish reading circuit file
s-a-0 fault at net17
s-a-1 fault at n60
Run stuck-at fault ATPG
backwardImply returns 2
LET n60 to be 0
Backtrace
FindPIAssignment process returns G2 1
Forward Simulation:
Fault Activiation: let n60 to 0
Fault Propagation G17
LET G17 to be 1
Backtrace
FindPIAssignment process returns net25 0
FindPIAssignment process returns net14 1
FindPIAssignment process returns G3 0
Forward Simulation:
Fault has propagated to output
the result of ATPG before assign unknown values
--------------------
G1 X
G2 1
G3 0
G4 X
G5 X
```

圖十三、n60 s-a-1 result

1. **為了讓 n60 fault activation**
2. **backtrace G2=1**
3. **forward simulation ->n60 fault activation**
4. **fault propagation 到 G17**
5. **backtrace net25 =0**
6. **backtrace net14 =1**
7. **backtrace G3=0**
8. **forward simulation 驗證輸出故障是否觀察到。**

方法:

透過在 atpg 中的以下 function 加入 cout 來判斷當前 atpg 執行到哪一步驟。

Podem(FAULT* fptr, unsigned &total_backtrack_num)

FindPIAssignment(GATEPTR gptr, VALUE value)

BackwardImply(GATEPTR gptr, VALUE value)

FaultEvaluate(FAULT* fptr)

TestPossible(FAULT* fptr)

d) 指令:

./atpg -random_pattern -output <pattern> [絕對路徑+circuit name]

./atpg -output <pattern> [絕對路徑+circuit name]

Fault coverage ->左邊為 random 符合 1000 個 pattern 或是達到 fault coverage=90%以上的 fault coverage, 右邊為跑完 random 後接續 atpg 後的結果

b17.bench

	Fault coverage	# of patterns	CPU time(s)
original	93.00%	87963	28095.37
random+atpg	51.21% ->94.04%	1000+36577	10487.74

```
[s110305504@cad podem]$  ./atpg -output normal_b17 b17.bench
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 87963
Total backtrack number = 95087176
---------------------------------------
Total fault number = 142884
Detected fault number = 132877
Undetected fault number = 10007
Abort fault number = 8378
Redundant fault number = 1629
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 132877
Equivalent undetected fault number = 10007
Equivalent abort fault number = 8378
Equivalent redundant fault number = 1629
---------------------------------------
Fault Coverge = 93.00%
Equivalent FC = 93.00%
Fault Efficiency = 94.07%
---------------------------------------
total CPU time = 28095.37
```

圖十四、b17.bench original version atpg result

```
[s110305504@cad podem]$ ./atpg -random_pattern -output b17_partd_random b17.bench
Start parsing input file
Finish reading circuit file
random pattern:
Generate stuck-at fault list
AllFaultList: 142884
Run stuck-at fault randomp pattern gerenration for 1000 times or 90% fault coverage
---------------------------------------
Random Test pattern number = 1000
Total backtrack number = 0
---------------------------------------
Total fault number = 142884
Detected fault number = 73176
Undetected fault number = 69708
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 73176
Equivalent undetected fault number = 69708
---------------------------------------
Fault Coverge = 51.21%
Equivalent FC = 51.21%
---------------------------------------
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 36577
Total backtrack number = 79992139
---------------------------------------
Total fault number = 142884
Detected fault number = 134363
Undetected fault number = 8521
Abort fault number = 7048
Redundant fault number = 1473
---------------------------------------
Total equivalent fault number = 142884
Equivalent detected fault number = 134363
Equivalent undetected fault number = 8521
Equivalent abort fault number = 7048
Equivalent redundant fault number = 1473
---------------------------------------
Fault Coverge = 94.04%
Equivalent FC = 94.04%
Fault Efficiency = 95.02%
---------------------------------------
total CPU time = 10487.74
```

圖十五、b17.bench random version result

s35932_com.bench

	Fault coverage	# of patterns	CPU time(s)
original	**89.64%**	**77**	**67.66**
random+atpg	**89.69% -> 89.69%**	**1000+0**	**69.33**

```
[s110305504@cad podem]$ ./atpg -output s35932_com_partd_atpg "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s35932_com.bench"
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 71224
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 77
Total backtrack number = 242709
---------------------------------------
Total fault number = 71224
Detected fault number = 63842
Undetected fault number = 7382
Abort fault number = 0
Redundant fault number = 7382
---------------------------------------
Total equivalent fault number = 71224
Equivalent detected fault number = 63842
Equivalent undetected fault number = 7382
Equivalent abort fault number = 0
Equivalent redundant fault number = 7382
---------------------------------------
Fault Coverge = 89.64%
Equivalent FC = 89.64%
Fault Efficiency = 100.00%
---------------------------------------
total CPU time = 67.66
```

圖十六、s35932_com.bench original version atpg result

```
[s110305504@cad podem]$ ./atpg -random_pattern -output s35932_com_partd_random "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s35932_com.bench"
Start parsing input file
Finish reading circuit file
random pattern:
Generate stuck-at fault list
AllFaultList: 71224
Run stuck-at fault randomp pattern gerenration for 1000 times or 90% fault coverage
---------------------------------------
Random Test pattern number = 1000
Total backtrack number = 0
---------------------------------------
Total fault number = 71224
Detected fault number = 63880
Undetected fault number = 7344
---------------------------------------
Total equivalent fault number = 71224
Equivalent detected fault number = 63880
Equivalent undetected fault number = 7344
---------------------------------------
Fault Coverge = 89.69%
Equivalent FC = 89.69%
---------------------------------------
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 0
Total backtrack number = 242688
---------------------------------------
Total fault number = 71224
Detected fault number = 63880
Undetected fault number = 7344
Abort fault number = 0
Redundant fault number = 7344
---------------------------------------
Total equivalent fault number = 71224
Equivalent detected fault number = 63880
Equivalent undetected fault number = 7344
Equivalent abort fault number = 0
Equivalent redundant fault number = 7344
---------------------------------------
Fault Coverge = 89.69%
Equivalent FC = 89.69%
Fault Efficiency = 100.00%
---------------------------------------
total CPU time = 69.33
```

圖十七、s35932_com.bench random version result

s38417_com.bench

	Fault coverage	# of patterns	CPU time(s)
original	**99.68%**	**1373**	**17.15**
random+atpg	**88.92% -> 99.67%**	**1000+1116**	**18.13**

```
[s110305504@cad podem]$ ./atpg -output s38417_com_partd_atpg "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s38417_com.bench"
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 76678
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 1373
Total backtrack number = 562177
---------------------------------------
Total fault number = 76678
Detected fault number = 76433
Undetected fault number = 245
Abort fault number = 40
Redundant fault number = 205
---------------------------------------
Total equivalent fault number = 76678
Equivalent detected fault number = 76433
Equivalent undetected fault number = 245
Equivalent abort fault number = 40
Equivalent redundant fault number = 205
---------------------------------------
Fault Coverge = 99.68%
Equivalent FC = 99.68%
Fault Efficiency = 99.95%
---------------------------------------
total CPU time = 17.15
```

圖十八、s38417_com.bench original version atpg result

```
[s110305504@cad podem]$ ./atpg -random_pattern -output s38417_com_partd_random "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s38417_com.bench"
Start parsing input file
Finish reading circuit file
random pattern:
Generate stuck-at fault list
AllFaultList: 76678
Run stuck-at fault randomp pattern gerenration for 1000 times or 90% fault coverage
---------------------------------------
Random Test pattern number = 1000
Total backtrack number = 0
---------------------------------------
Total fault number = 76678
Detected fault number = 68181
Undetected fault number = 8497
---------------------------------------
Total equivalent fault number = 76678
Equivalent detected fault number = 68181
Equivalent undetected fault number = 8497
---------------------------------------
Fault Coverge = 88.92%
Equivalent FC = 88.92%
---------------------------------------
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 1116
Total backtrack number = 519647
---------------------------------------
Total fault number = 76678
Detected fault number = 76427
Undetected fault number = 251
Abort fault number = 46
Redundant fault number = 205
---------------------------------------
Total equivalent fault number = 76678
Equivalent detected fault number = 76427
Equivalent undetected fault number = 251
Equivalent abort fault number = 46
Equivalent redundant fault number = 205
---------------------------------------
Fault Coverge = 99.67%
Equivalent FC = 99.67%
Fault Efficiency = 99.94%
---------------------------------------
total CPU time = 18.13
```

圖十九、s38417_com.bench random version result

s38584_com.bench

	Fault coverage	# of patterns	CPU time(s)
original	**95.57%**	**856**	**8.20**
random+atpg	**87.71% -> 95.57%**	**1000+614**	**11.24**

```
[s110305504@cad podem]$ ./atpg -output s38584_com_partd_atpg "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s38584_com.bench"
Start parsing input file
Finish reading circuit file
Generate stuck-at fault list
AllFaultList: 76864
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 856
Total backtrack number = 96247
---------------------------------------
Total fault number = 76864
Detected fault number = 73457
Undetected fault number = 3407
Abort fault number = 3
Redundant fault number = 3404
---------------------------------------
Total equivalent fault number = 76864
Equivalent detected fault number = 73457
Equivalent undetected fault number = 3407
Equivalent abort fault number = 3
Equivalent redundant fault number = 3404
---------------------------------------
Fault Coverge = 95.57%
Equivalent FC = 95.57%
Fault Efficiency = 100.00%
---------------------------------------
total CPU time = 8.20
```

圖二十、s38584_com.bench original version atpg result

```
[s110305504@cad podem]$ ./atpg -random_pattern -output s38584_com_partd_random "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas89_com/s38584_com.bench"
Start parsing input file
Finish reading circuit file
random pattern:
Generate stuck-at fault list
AllFaultList: 76864
Run stuck-at fault randomp pattern gerenration for 1000 times or 90% fault coverage
---------------------------------------
Random Test pattern number = 1000
Total backtrack number = 0
---------------------------------------
Total fault number = 76864
Detected fault number = 67417
Undetected fault number = 9447
---------------------------------------
Total equivalent fault number = 76864
Equivalent detected fault number = 67417
Equivalent undetected fault number = 9447
---------------------------------------
Fault Coverge = 87.71%
Equivalent FC = 87.71%
---------------------------------------
Run stuck-at fault ATPG
---------------------------------------
Test pattern number = 614
Total backtrack number = 96246
---------------------------------------
Total fault number = 76864
Detected fault number = 73457
Undetected fault number = 3407
Abort fault number = 3
Redundant fault number = 3404
---------------------------------------
Total equivalent fault number = 76864
Equivalent detected fault number = 73457
Equivalent undetected fault number = 3407
Equivalent abort fault number = 3
Equivalent redundant fault number = 3404
---------------------------------------
Fault Coverge = 95.57%
Equivalent FC = 95.57%
Fault Efficiency = 100.00%
---------------------------------------
total CPU time = 11.24
```

圖二十一、s38584_com.bench random version result

通過以上可發現當電路大的時候，先使用 random pattern 再使用 atpg 可以加快速度，並且提升 fault covergae。電路較小時，fault coverage 基本相同，但速度會相較只使用 atpg 慢。

Part d 模仿 atpg 新增 random_pattern function，並在產生 1000 個 pattern 前一直判斷 fault coverage，來判斷是否有達到 fault coverage = 90%暫停的條件。兩個條件之一達成後，再使用 atpg 繼續後面的 fault simulation。最終印出結果。

e) 指令:

./atpg -bridging_atpg -output {pattern} [絕對路徑+circuit name]

./atpg -bridging_fsim -input {pattern} [絕對路徑+circuit name]

我通過將 assignment 4 產生的 and bridging fault 和 or bridginf fault，分別當作 s-a-0 和 s-a-1 去做模擬，通過模仿 atpg 去撰寫 atpg_bridge()的 function。
之後通過 atpg_bridge()產生的 pattern 去跑 assignment5 的 bridging_fsim 來確認結果。

```
[s110305504@cad podem]$ ./atpg -bridging_atpg -output c17_ass6_e "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas85/c17.bench"
Start parsing input file
Finish reading circuit file
BFLIST: 16
Run bridge fault ATPG
---------------------------------------
Test pattern number = 5
Total backtrack number = 0
---------------------------------------
Total fault number = 16
Detected fault number = 16
Undetected fault number = 0
Abort fault number = 0
Redundant fault number = 0
---------------------------------------
Total equivalent fault number = 16
Equivalent detected fault number = 16
Equivalent undetected fault number = 0
Equivalent abort fault number = 0
Equivalent redundant fault number = 0
---------------------------------------
Fault Coverge = 100.00%
Equivalent FC = 100.00%
Fault Efficiency = 100.00%
---------------------------------------
total CPU time = 0.00
```

圖二十二、c17.bench bridging_atpg 結果

```
[s110305504@cad podem]$ ./atpg -bridging_fsim -input c17_ass6_e "/home/Student113/s110305504/VLSI_Testing/Assignment6/circuits/iscas85/c17.bench"
Start parsing input file
Finish reading circuit file
Run bridging fault simulation
Found fault number :8
Found fault number :2
Found fault number :1
Found fault number :3
Found fault number :2
---------------------------------------
Test pattern number = 5
---------------------------------------
Total fault number = 16
Detected fault number = 16
Undetected fault number = 0
---------------------------------------
Equivalent fault number = 16
Equivalent detected fault number = 16
Equivalent undetected fault number = 0
---------------------------------------
Fault Coverge = 100.00%
Equivalent FC = 100.00%
---------------------------------------
total CPU time = 0.00
```

圖二十三、c17.bench bridging_fsim 結果

結果: c17.bench 通過 bridging_atpg 產生五個 pattern，且 fault coverage = 100。

Compile:

make