CHANNEL 分配情況
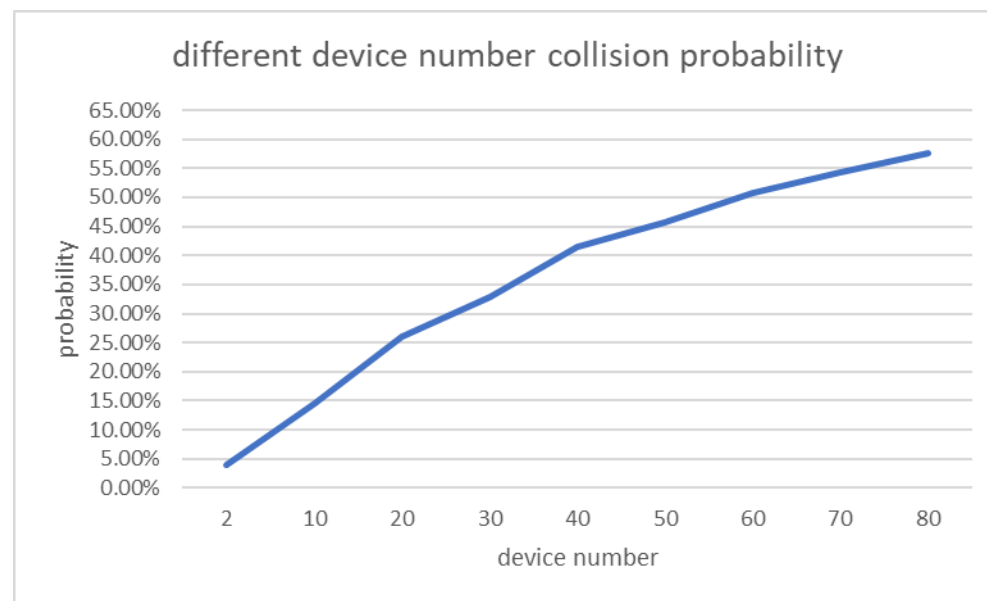
Channel 0~55　　for (all device*0.3)

Channel 56~79　　for (all device*0.7)

(1)

```
maxhsu@Max-Hsu:/mnt/c/Users/Max-Hsu/Desktop/homework/wireless/hw1$ ./HW1
100
alarm
device: 2      after: 100 sec      total collision:7798      total hop:200928      probability: 0.038810
```

(2)

(3)(a)如果是 bad channel 選擇附近的 channel 旁邊通常還是 bad channel，所以
沒有甚麼差別

```
maxhsu@Max-Hsu:/mnt/c/Users/Max-Hsu/Desktop/homework/wireless/hw3/hw3-1$ ./HW3-1
Marking bad channel 0.100000  device: 40    after: 1 sec    total collision:15941    total hop:38877    probability: 0.410037
method1 bad_channel 0.100000  device: 40    after: 1 sec    total collision:16523    total hop:39491    probability: 0.418399

Marking bad channel 0.200000  device: 40    after: 1 sec    total collision:16058    total hop:38441    probability: 0.417731
method1 bad_channel 0.200000  device: 40    after: 1 sec    total collision:15428    total hop:37476    probability: 0.411677

Marking bad channel 0.300000  device: 40    after: 1 sec    total collision:16735    total hop:40562    probability: 0.412578
method1 bad_channel 0.300000  device: 40    after: 1 sec    total collision:15328    total hop:38487    probability: 0.398264

Marking bad channel 0.400000  device: 40    after: 1 sec    total collision:14457    total hop:35577    probability: 0.406358
method1 bad_channel 0.400000  device: 40    after: 1 sec    total collision:13626    total hop:32438    probability: 0.420063

Marking bad channel 0.500000  device: 40    after: 1 sec    total collision:15050    total hop:37483    probability: 0.401515
method1 bad_channel 0.500000  device: 40    after: 1 sec    total collision:17131    total hop:36501    probability: 0.469330

Marking bad channel 0.600000  device: 40    after: 1 sec    total collision:16585    total hop:40530    probability: 0.409203
method1 bad_channel 0.600000  device: 40    after: 1 sec    total collision:15293    total hop:36470    probability: 0.419331

Marking bad channel 0.700000  device: 40    after: 1 sec    total collision:15254    total hop:37473    probability: 0.407066
method1 bad_channel 0.700000  device: 40    after: 1 sec    total collision:15659    total hop:39479    probability: 0.396641

Marking bad channel 0.800000  device: 40    after: 1 sec    total collision:16640    total hop:40285    probability: 0.413057
method1 bad_channel 0.800000  device: 40    after: 1 sec    total collision:16190    total hop:40546    probability: 0.399300

Marking bad channel 0.900000  device: 40    after: 1 sec    total collision:15863    total hop:38973    probability: 0.407025
method1 bad_channel 0.900000  device: 40    after: 1 sec    total collision:16723    total hop:40336    probability: 0.414592
```

```
Marking bad channel 0.100000  device: 80   after: 1 sec   total collision:45191   total hop:78896   probability: 0.572792
method1 bad_channel 0.100000  device: 80   after: 1 sec   total collision:45239   total hop:79003   probability: 0.572624

Marking bad channel 0.200000  device: 80   after: 1 sec   total collision:44778   total hop:77972   probability: 0.574283
method1 bad_channel 0.200000  device: 80   after: 1 sec   total collision:43876   total hop:76905   probability: 0.570522

Marking bad channel 0.300000  device: 80   after: 1 sec   total collision:42828   total hop:74548   probability: 0.574502
method1 bad_channel 0.300000  device: 80   after: 1 sec   total collision:45105   total hop:76962   probability: 0.586068

Marking bad channel 0.400000  device: 80   after: 1 sec   total collision:44904   total hop:78270   probability: 0.573706
method1 bad_channel 0.400000  device: 80   after: 1 sec   total collision:45510   total hop:77743   probability: 0.585390

Marking bad channel 0.500000  device: 80   after: 1 sec   total collision:44617   total hop:77918   probability: 0.572615
method1 bad_channel 0.500000  device: 80   after: 1 sec   total collision:45034   total hop:77073   probability: 0.584303

Marking bad channel 0.600000  device: 80   after: 1 sec   total collision:43127   total hop:75725   probability: 0.569521
method1 bad_channel 0.600000  device: 80   after: 1 sec   total collision:45485   total hop:77708   probability: 0.585332

Marking bad channel 0.700000  device: 80   after: 1 sec   total collision:42683   total hop:77242   probability: 0.552588
method1 bad_channel 0.700000  device: 80   after: 1 sec   total collision:45949   total hop:78328   probability: 0.586623

Marking bad channel 0.800000  device: 80   after: 1 sec   total collision:44664   total hop:78197   probability: 0.571173
method1 bad_channel 0.800000  device: 80   after: 1 sec   total collision:43857   total hop:76781   probability: 0.571196

Marking bad channel 0.900000  device: 80   after: 1 sec   total collision:44892   total hop:77866   probability: 0.576529
method1 bad_channel 0.900000  device: 80   after: 1 sec   total collision:44428   total hop:77587   probability: 0.572622
```

(3)(b)如果是 bad channel 選擇離該 channel 最遠的，0~39 會選 79，40~79 會選 0 造成更大的 collision


```
maxhsu@Max-Hsu:/mnt/c/Users/Max-Hsu/Desktop/homework/wireless/hw3/hw3-2$ ./HW3-2
Marking bad channel 0.100000  device: 40   after: 1 sec   total collision:15704   total hop:37903   probability: 0.414321
method2 bad_channel 0.100000  device: 40   after: 1 sec   total collision:15567   total hop:37970   probability: 0.409982

Marking bad channel 0.200000  device: 40   after: 1 sec   total collision:15392   total hop:37613   probability: 0.409220
method2 bad_channel 0.200000  device: 40   after: 1 sec   total collision:23206   total hop:34948   probability: 0.664015

Marking bad channel 0.300000  device: 40   after: 1 sec   total collision:14276   total hop:35278   probability: 0.404671
method2 bad_channel 0.300000  device: 40   after: 1 sec   total collision:26172   total hop:37089   probability: 0.705654

Marking bad channel 0.400000  device: 40   after: 1 sec   total collision:15829   total hop:38213   probability: 0.414231
method2 bad_channel 0.400000  device: 40   after: 1 sec   total collision:27738   total hop:39060   probability: 0.710138

Marking bad channel 0.500000  device: 40   after: 1 sec   total collision:14496   total hop:34617   probability: 0.418754
method2 bad_channel 0.500000  device: 40   after: 1 sec   total collision:25751   total hop:37124   probability: 0.693648

Marking bad channel 0.600000  device: 40   after: 1 sec   total collision:15516   total hop:38273   probability: 0.405403
method2 bad_channel 0.600000  device: 40   after: 1 sec   total collision:14952   total hop:36756   probability: 0.406791

Marking bad channel 0.700000  device: 40   after: 1 sec   total collision:15937   total hop:39043   probability: 0.408191
method2 bad_channel 0.700000  device: 40   after: 1 sec   total collision:15743   total hop:38149   probability: 0.412671

Marking bad channel 0.800000  device: 40   after: 1 sec   total collision:15785   total hop:38033   probability: 0.415034
method2 bad_channel 0.800000  device: 40   after: 1 sec   total collision:15158   total hop:36360   probability: 0.416887

Marking bad channel 0.900000  device: 40   after: 1 sec   total collision:14686   total hop:37036   probability: 0.396533
method2 bad_channel 0.900000  device: 40   after: 1 sec   total collision:15620   total hop:37175   probability: 0.420175
```

```
Marking bad channel 0.100000  device: 80   after: 1 sec   total collision:42263   total hop:74237   probability: 0.569298
method2 bad_channel 0.100000  device: 80   after: 1 sec   total collision:44599   total hop:77628   probability: 0.574522

Marking bad channel 0.200000  device: 80   after: 1 sec   total collision:42002   total hop:74658   probability: 0.562592
method2 bad_channel 0.200000  device: 80   after: 1 sec   total collision:41906   total hop:73087   probability: 0.573371

Marking bad channel 0.300000  device: 80   after: 1 sec   total collision:41952   total hop:73339   probability: 0.572029
method2 bad_channel 0.300000  device: 80   after: 1 sec   total collision:42614   total hop:74427   probability: 0.572561

Marking bad channel 0.400000  device: 80   after: 1 sec   total collision:43373   total hop:75738   probability: 0.572672
method2 bad_channel 0.400000  device: 80   after: 1 sec   total collision:57984   total hop:76053   probability: 0.762416

Marking bad channel 0.500000  device: 80   after: 1 sec   total collision:44071   total hop:77218   probability: 0.570735
method2 bad_channel 0.500000  device: 80   after: 1 sec   total collision:57025   total hop:74454   probability: 0.765909

Marking bad channel 0.600000  device: 80   after: 1 sec   total collision:42277   total hop:73857   probability: 0.572417
method2 bad_channel 0.600000  device: 80   after: 1 sec   total collision:57466   total hop:76158   probability: 0.754563

Marking bad channel 0.700000  device: 80   after: 1 sec   total collision:43483   total hop:75350   probability: 0.577080
method2 bad_channel 0.700000  device: 80   after: 1 sec   total collision:45520   total hop:72791   probability: 0.625352

Marking bad channel 0.800000  device: 80   after: 1 sec   total collision:42730   total hop:74515   probability: 0.573442
method2 bad_channel 0.800000  device: 80   after: 1 sec   total collision:42556   total hop:74266   probability: 0.573021

Marking bad channel 0.900000  device: 80   after: 1 sec   total collision:41946   total hop:74645   probability: 0.561940
method2 bad_channel 0.900000  device: 80   after: 1 sec   total collision:42273   total hop:74892   probability: 0.564453
```

(3)(c)當全部 channel 被標注成 bad channel 時狀況與原本一樣

```
 1  bcr:139964833335040 after 529  1022
 2  bcr:139964968601344 after 542  1024
 3  bcr:139964824880896 after 561  1021
 4  bcl:139964714977024 after 155  1021
 5  bcl:139964723431168 after 165  1019
 6  bcr:139964782610176 after 539  1022
 7  bcr:139964791064320 after 539  1022
 8  bcr:139964960147200 after 499  1023
 9  bcr:139964858697472 after 533  1023
10  bcr:139964850243328 after 546  1022
11  bcl:139964655798016 after 170  1018
12  bcr:139964816426752 after 514  1022
13  bcr:139964951693056 after 546  1021
14  bcr:139964892514048 after 535  1022
15  bcl:139964647343872 after 182  1021
16  bcr:139964977055488 after 526  1026
17  bcr:139964917876480 after 571  1024
18  bcr:139964926330624 after 526  1022
19  bcl:139964689614592 after 166  1020
20  bcr:139964867151616 after 538  1023
21  bcl:139964681160448 after 146  1020
22  bcr:139964757247744 after 542  1021
23  bcr:139964884059904 after 541  1024
24  bcl:139964672706304 after 152  1021
25  bcl:139964698068736 after 153  1020
26  bcr:139964748793600 after 541  1022
27  bcr:139964909422336 after 540  1023
28  bcr:139964900968192 after 527  1021
29  bcr:139964765701888 after 523  1022
30  bcr:139964934784768 after 537  1025
31  bcr:139964875605760 after 544  1020
32  bcr:139964841789184 after 543  1023
33  bcl:139964740339456 after 153  1020
34  bcl:139964706522880 after 168  1021
35  bcl:139964731885312 after 176  1022
36  bcr:139964799518464 after 542  1022
37  bcl:139964664252160 after 153  1018
38  bcr:139964943238912 after 571  1025
39  bcr:139964807972608 after 519  1022
40  bcr:139964774156032 after 524  1022
41  Marking bad channel 0.100000  device: 40   after: 1 sec → total collision:15316 → total hop:37805 → probability: 0.405132
42  clean  0  ,bad  80
43  cr:139964875605760 after 472  912
44  cr:139964850243328 after 479  910
45  cr:139964977055488 after 486  912
46  cr:139964833335040 after 481  910
47  cl:139964706522880 after 149  908
48  cr:139964655798016 after 429  913
49  cr:139964884059904 after 472  912
50  cr:139964892514048 after 481  908
51  cl:139964740339456 after 136  909
52  cr:139964858697472 after 477  910
```

```
41  Marking bad channel 0.100000  device: 40   after: 1 sec → total collision:15316 → total hop:37805 → probability: 0.405132
42  clean  0  ,bad  80
43  cr:139964875605760 after 472  912
44  cr:139964850243328 after 479  910
45  cr:139964977055488 after 486  912
46  cr:139964833335040 after 481  910
47  cl:139964706522880 after 149  908
48  cr:139964655798016 after 429  913
49  cr:139964884059904 after 472  912
50  cr:139964892514048 after 481  908
51  cl:139964740339456 after 136  909
52  cr:139964858697472 after 477  910
53  cr:139964664252160 after 466  912
54  cr:139964824880896 after 489  910
55  cl:139964774156032 after 151  912
56  cr:139964934784768 after 494  913
57  cr:139964926330624 after 481  910
58  cr:139964807972608 after 503  910
59  cr:139964951693056 after 509  913
60  cl:139964748793600 after 151  908
61  cl:139964681160448 after 122  904
62  cr:139964841789184 after 475  910
63  cr:139964647343872 after 481  916
64  cr:139964782610176 after 495  907
65  cl:139964765701888 after 163  909
66  cr:139964791064320 after 479  907
67  cr:139964968601344 after 459  913
68  cr:139964917876480 after 490  913
69  cl:139964723431168 after 141  906
70  cr:139964909422336 after 482  912
71  cl:139964731885312 after 129  907
72  cr:139964799518464 after 476  909
73  cr:139964816426752 after 471  910
74  cr:139964943238912 after 473  915
75  cl:139964689614592 after 141  905
76  cr:139964900968192 after 480  912
77  cr:139964960147200 after 461  913
78  cl:139964698068736 after 137  909
79  cr:139964672706304 after 444  911
80  cr:139964867151616 after 494  911
81  cl:139964757247744 after 154  906
82  cl:139964714977024 after 145  904
83  method3 bad_channel 0.100000  device: 40   after: 1 sec → total collision:14626 → total hop:35489 → probability: 0.412128
84  
85  bcl:139964765701888 after 153  989
86  bcl:139964655798016 after 145  995
87  bcl:139964731885312 after 169  988
88  bcr:139964833335040 after 497  989
```

當有一部份被 mark 成 bad channel 時，該 channel 會尋找 clean channel，
與 clean channel 搶頻道，使得 channel 分配均等

```
 86  bcl:139964655798016 after 145  995
 87  bcl:139964731885312 after 169  988
 88  bcr:139964833335040 after 497  989
 89  bcr:139964689614592 after 533  1000
 90  bcr:139964867151616 after 514  994
 91  bcl:139964647343872 after 139  992
 92  bcl:139964740339456 after 153  986
 93  bcl:139964672706304 after 164  987
 94  bcr:139964824880896 after 515  995
 95  bcr:139964807972608 after 525  990
 96  bcr:139964943238912 after 492  993
 97  bcr:139964816426752 after 523  994
 98  bcr:139964884059904 after 536  999
 99  bcr:139964968601344 after 522  994
100  bcr:139964841789184 after 547  988
101  bcl:139964714977024 after 161  990
102  bcr:139964934784768 after 522  995
103  bcr:139964900968192 after 552  994
104  bcl:139964723431168 after 174  991
105  bcr:139964951693056 after 511  999
106  bcr:139964917876480 after 503  997
107  bcl:139964774156032 after 161  985
108  bcl:139964664252160 after 156  990
109  bcl:139964748793600 after 179  993
110  bcr:139964875605760 after 512  989
111  bcr:139964799518464 after 507  988
112  bcr:139964782610176 after 524  993
113  bcr:139964960147200 after 512  1005
114  bcr:139964681160448 after 529  995
115  bcr:139964892514048 after 504  998
116  bcr:139964858697472 after 528  998
117  bcr:139964909422336 after 529  990
118  bcr:139964791064320 after 536  998
119  bcr:139964850243328 after 547  995
120  bcr:139964926330624 after 529  997
121  bcl:139964757247744 after 166  996
122  bcr:139964706522880 after 522  998
123  bcr:139964698068736 after 516  1006
124  bcr:139964977055488 after 508  991
125  Marking bad channel 0.200000  device: 40   after: 1 sec — total collision:16362 — total hop:38758 — probability: 0.422158
126  clean  56  ,bad  24
127  cr:139964960147200 after 404  1008
128  cr:139964977055488 after 411  996
129  cr:139964799518464 after 427  1003
```

```
128  cr:139964977055488 after 411  996
129  cr:139964799518464 after 427  1003
130  cr:139964951693056 after 387  1012
131  cr:139964672706304 after 416  1006
132  cr:139964655798016 after 425  1003
133  cr:139964850243328 after 398  1011
134  cl:139964689614592 after 401  1009
135  cl:139964731885312 after 398  1001
136  cl:139964774156032 after 421  1003
137  cr:139964884059904 after 428  1008
138  cr:139964664252160 after 421  1010
139  cr:139964926330624 after 408  1010
140  cr:139964934784768 after 428  1005
141  cr:139964647343872 after 404  1003
142  cr:139964782610176 after 412  1009
143  cr:139964816426752 after 434  1006
144  cl:139964681160448 after 391  1004
145  cl:139964740339456 after 380  1000
146  cl:139964909422336 after 397  1003
147  cr:139964892514048 after 367  1009
148  cl:139964723431168 after 383  1010
149  cl:139964698068736 after 381  1000
150  cl:139964748793600 after 393  1007
151  cr:139964900968192 after 425  1001
152  cl:139964714977024 after 430  1006
153  cl:139964706522880 after 400  1002
154  cr:139964858697472 after 411  1011
155  cl:139964765701888 after 381  1004
156  cr:139964943238912 after 397  1003
157  cr:139964824880896 after 421  1011
158  cl:139964757247744 after 408  1008
159  cr:139964807972608 after 391  1002
160  cr:139964867151616 after 405  1003
161  cr:139964833335040 after 382  1004
162  cr:139964917876480 after 393  1014
163  cr:139964841789184 after 389  1000
164  cr:139964875605760 after 429  1000
165  cr:139964968601344 after 397  1004
166  cr:139964791064320 after 408  1009
167  method3 bad_channel 0.200000  device: 40   after: 1 sec — total collision:15795 — total hop:39206 — probability: 0.402872
168
169  bcr:139964900968192 after 503  976
170  bcl:139964833335040 after 516  979
171  bcl:139964672706304 after 160  975
172  bcr:139964807972608 after 516  974
```

當全部的 channel 被 mark 成 clean 時與原本的情況一樣


```
591  bcr:139964698068736 after 474  898
592  bcr:139964841789184 after 459  899
593  bcr:139964799518464 after 461  902
594  bcr:139964917876480 after 497  901
595  bcl:139964647343872 after 151  896
596  bcr:139964934784768 after 476  902
597  bcr:139964977055488 after 454  901
598  bcl:139964655798016 after 151  894
599  bcr:139964850243328 after 480  899
600  bcr:139964968601344 after 453  904
601  bcl:139964672706304 after 138  896
602  bcr:139964681160448 after 479  902
603  bcr:139964960147200 after 462  902
604  bcr:139964943238912 after 436  902
605  bcr:139964884059904 after 454  901
606  bcr:139964807972608 after 451  902
607  bcl:139964748793600 after 138  898
608  bcr:139964875605760 after 445  902
609  bcr:139964782610176 after 470  899
610  bcr:139964867151616 after 486  898
611  bcl:139964731885312 after 134  900
612  bcl:139964765701888 after 140  901
613  bcl:139964740339456 after 131  902
614  bcr:139964909422336 after 477  903
615  bcr:139964791064320 after 466  898
616  bcr:139964833335040 after 489  900
617  bcl:139964774156032 after 145  897
618  bcl:139964723431168 after 124  897
619  bcl:139964664252160 after 152  899
620  bcr:139964824880896 after 473  896
621  bcr:139964892514048 after 470  898
622  bcl:139964714977024 after 153  896
623  bcl:139964757247744 after 145  897
624  bcr:139964926330624 after 489  900
625  bcr:139964951693056 after 489  900
626  bcr:139964816426752 after 482  900
627  bcr:139964858697472 after 483  897
628  bcr:139964706522880 after 473  902
629  Marking bad channel 0.800000  device: 40    after: 1 sec    total collision:14408    total hop:35987    probability: 0.400367
630  clean  80  ,bad   0
631  cr:139964943238912 after 487  912
632  cl:139964774156032 after 155  913
```



```
632  cl:139964774156032 after 155  913
633  cr:139964884059904 after 503  913
634  cl:139964689614592 after 149  911
635  cr:139964655798016 after 461  916
636  cr:139964968601344 after 448  914
637  cr:139964850243328 after 480  914
638  cr:139964858697472 after 484  915
639  cr:139964824880896 after 479  913
640  cr:139964892514048 after 472  913
641  cr:139964977055488 after 485  914
642  cr:139964841789184 after 501  913
643  cl:139964681160448 after 133  910
644  cl:139964757247744 after 143  913
645  cl:139964706522880 after 125  910
646  cr:139964926330624 after 478  914
647  cr:139964900968192 after 461  912
648  cl:139964740339456 after 136  911
649  cr:139964934784768 after 489  915
650  cr:139964816426752 after 451  914
651  cl:139964714977024 after 153  910
652  cl:139964748793600 after 148  912
653  cr:139964960147200 after 476  914
654  cr:139964875605760 after 457  913
655  cr:139964664252160 after 495  914
656  cl:139964698068736 after 150  912
657  cr:139964917876480 after 456  916
658  cr:139964799518464 after 475  911
659  cl:139964731885312 after 156  912
660  cr:139964672706304 after 477  915
661  cr:139964791064320 after 487  914
662  cr:139964951693056 after 472  914
663  cl:139964765701888 after 150  913
664  cr:139964833335040 after 469  912
665  cr:139964867151616 after 472  913
666  cr:139964782610176 after 471  910
667  cr:139964909422336 after 490  915
668  cr:139964647343872 after 493  916
669  cl:139964723431168 after 136  912
670  cr:139964807972608 after 498  911
671  method3 bad_channel 0.800000  device: 40    after: 1 sec    total collision:14014    total hop:33780    probability: 0.41486
672
673  bcl:139964664252160 after 150  940
674  bcl:139964774156032 after 131  944
675  bcr:139964824880896 after 500  941
676  bcl:139964655798016 after 188  942
677  bcr:139964850243328 after 492  942
678  bcr:139964791064320 after 490  942
```

當全部的 channel 被 mark 成 clean 時與原本的情況一樣

(3)(d) 當全部都被 mark 成 bad channel 時，沒有 clean channel 可以選，結果與原本相同

```
 1  bcr:140164381411072 after 551   1017
 2  bcr:140164415227648 after 521   1016
 3  bcr:140164457498368 after 540   1016
 4  bcr:140164465952512 after 511   1019
 5  bcr:140164525131520 after 559   1019
 6  bcl:140164263053056 after 165   1015
 7  bcr:140164339140352 after 505   1017
 8  bcl:140164288415488 after 159   1016
 9  bcr:140164533585664 after 548   1021
10  bcr:140164542039808 after 529   1021
11  bcr:140164449044224 after 536   1017
12  bcr:140164389865216 after 551   1017
13  bcl:140164279961344 after 155   1014
14  bcr:140164372956928 after 571   1017
15  bcr:140164398319360 after 524   1018
16  bcl:140164246144768 after 187   1017
17  bcr:140164432135936 after 513   1018
18  bcl:140164305323776 after 175   1018
19  bcr:140164516677376 after 537   1018
20  bcr:140164499769088 after 532   1020
21  bcr:140164364502784 after 540   1017
22  bcr:140164491314944 after 528   1018
23  bcr:140164347594496 after 508   1015
24  bcr:140164330686208 after 547   1016
25  bcr:140164508223232 after 530   1021
26  bcl:140164212328192 after 165   1014
27  bcl:140164237690624 after 137   1014
28  bcr:140164440590080 after 519   1019
29  bcl:140164296869632 after 146   1018
30  bcr:140164406773504 after 519   1019
31  bcr:140164474406656 after 543   1020
32  bcl:140164271507200 after 189   1015
33  bcr:140164423681792 after 510   1017
34  bcr:140164482860800 after 542   1019
35  bcl:140164220782336 after 144   1014
36  bcr:140164322232064 after 550   1016
37  bcr:140164356048640 after 556   1017
38  bcr:140164313777920 after 538   1014
39  bcl:140164229236480 after 187   1015
40  bcl:140164254598912 after 181   1012
41  Marking bad channel 0.100000  device: 40   after: 1 sec —→ total collision:16639 —→ total hop:38652 —→ probability: 0.430482
42  clean   0 ,bad  80
43  cr:140164482860800 after 537   999
44  cl:140164330686208 after 165   996
```

```
40  bcl:140164254598912 after 181   1012
41  Marking bad channel 0.100000  device: 40   after: 1 sec —→ total collision:16639 —→ total hop:38652 —→ probability: 0.430482
42  clean   0 ,bad  80
43  cr:140164482860800 after 537   999
44  cl:140164330686208 after 165   996
45  cr:140164516677376 after 502   999
46  cr:140164499769088 after 510   1000
47  cr:140164423681792 after 503   997
48  cr:140164212328192 after 520   1002
49  cl:140164322232064 after 156   994
50  cr:140164415227648 after 499   997
51  cl:140164246144768 after 165   992
52  cl:140164296869632 after 159   995
53  cr:140164237690624 after 518   1000
54  cr:140164542039808 after 518   1001
55  cl:140164313777920 after 153   996
56  cr:140164381411072 after 503   996
57  cr:140164372956928 after 521   997
58  cr:140164457498368 after 507   999
59  cr:140164398319360 after 508   998
60  cr:140164533585664 after 511   1001
61  cr:140164356048640 after 515   995
62  cr:140164432135936 after 521   998
63  cr:140164220782336 after 531   1001
64  cl:140164288415488 after 159   994
65  cl:140164263053056 after 150   993
66  cr:140164508223232 after 514   1000
67  cr:140164525131520 after 519   1000
68  cl:140164254598912 after 171   993
69  cr:140164389865216 after 524   997
70  cr:140164474406656 after 506   998
71  cr:140164449044224 after 525   998
72  cr:140164465952512 after 518   1000
73  cr:140164229236480 after 538   1001
74  cr:140164491314944 after 527   1000
75  cl:140164339140352 after 182   996
76  cr:140164347594496 after 528   996
77  cr:140164406773504 after 522   998
78  cl:140164279961344 after 140   994
79  cr:140164364502784 after 549   997
80  cl:140164305323776 after 165   995
81  cl:140164271507200 after 176   994
82  cr:140164440590080 after 508   998
83  method4 bad_channel 0.100000  device: 40   after: 1 sec —→ total collision:15936 —→ total hop:38896 —→ probability: 0.409708
84
85  bcr:140164364502784 after 536   989
86  bcr:140164440590080 after 535   989
87  bcl:140164220782336 after 161   985
88  bcr:140164432135936 after 510   989
```

當有部分被 mark 成 clean channel 時，全部的 device 會用 clean channel 去搶資源，可使全 collision 機率降低，但原先使用 clean channel 的 device 可能會遇到更多的碰撞

```
336
337  bcr:140164271507200 after 540  995
338  bcr:140164542039808 after 517  994
339  bcl:140164296869632 after 152  989
340  bcl:140164237690624 after 168  988
341  bcl:140164229236480 after 191  989
342  bcr:140164398319360 after 508  992
343  bcr:140164406773504 after 528  992
344  bcr:140164372956928 after 483  991
345  bcr:140164364502784 after 515  990
346  bcr:140164432135936 after 532  993
347  bcr:140164499769088 after 522  994
348  bcr:140164347594496 after 535  991
349  bcr:140164525131520 after 537  994
350  bcr:140164457498368 after 531  992
351  bcr:140164491314944 after 520  993
352  bcl:140164330686208 after 149  989
353  bcr:140164246144768 after 486  996
354  bcr:140164533585664 after 500  995
355  bcl:140164339140352 after 160  989
356  bcr:140164482860800 after 499  993
357  bcr:140164356048640 after 523  990
358  bcr:140164381411072 after 516  991
359  bcr:140164474406656 after 506  993
360  bcr:140164465952512 after 507  993
361  bcl:140164220782336 after 141  988
362  bcr:140164449044224 after 518  992
363  bcr:140164508223232 after 508  994
364  bcl:140164212328192 after 148  988
365  bcr:140164389865216 after 513  991
366  bcr:140164254598912 after 507  995
367  bcr:140164516677376 after 505  995
368  bcr:140164440590080 after 521  993
369  bcl:140164305323776 after 152  990
370  bcl:140164288415488 after 146  988
371  bcr:140164415227648 after 521  992
372  bcl:140164322232064 after 160  989
373  bcr:140164423681792 after 518  993
374  bcl:140164279961344 after 164  989
375  bcr:140164263053056 after 522  994
376  bcl:140164313777920 after 153  989
377  Marking bad channel 0.500000  device: 40   after: 1 sec ── total collision:15471 ── total hop:36694 → probability: 0.421622
378  clean  58  ,bad  22
379  cr:140164423681792 after 124  1012
```

```
375  bcr:140164263053056 after 522  994
376  bcl:140164313777920 after 153  989
377  Marking bad channel 0.500000  device: 40   after: 1 sec ── total collision:15471 ── total hop:36694 → probability: 0.421622
378  clean  58  ,bad  22
379  cr:140164423681792 after 124  1012
380  cr:140164212328192 after 122  1016
381  cl:140164254598912 after 186  1008
382  cr:140164415227648 after 167  1011
383  cl:140164288415488 after 175  1009
384  cr:140164381411072 after 133  1010
385  cr:140164533585664 after 156  1014
386  cl:140164271507200 after 196  1009
387  cl:140164322232064 after 190  1010
388  cl:140164339140352 after 178  1009
389  cr:140164440590080 after 145  1013
390  cr:140164364502784 after 113  1010
391  cr:140164398319360 after 138  1011
392  cr:140164542039808 after 142  1015
393  cl:140164263053056 after 202  1010
394  cr:140164491314944 after 168  1014
395  cr:140164347594496 after 138  1011
396  cr:140164356048640 after 139  1012
397  cr:140164508223232 after 148  1016
398  cr:140164499769088 after 158  1016
399  cr:140164516677376 after 156  1016
400  cr:140164406773504 after 150  1014
401  cr:140164525131520 after 120  1014
402  cl:140164279961344 after 184  1010
403  cr:140164389865216 after 151  1014
404  cr:140164220782336 after 162  1016
405  cl:140164313777920 after 189  1010
406  cl:140164296869632 after 176  1013
407  cl:140164330686208 after 193  1011
408  cr:140164237690624 after 145  1015
409  cr:140164457498368 after 144  1016
410  cr:140164474406656 after 136  1014
411  cr:140164229236480 after 149  1015
412  cl:140164246144768 after 187  1010
413  cr:140164465952512 after 151  1014
414  cr:140164449044224 after 130  1014
415  cl:140164305323776 after 169  1011
416  cr:140164372956928 after 139  1013
417  cr:140164482860800 after 114  1014
418  cr:140164432135936 after 153  1014
419  method4 bad_channel 0.500000  device: 40   after: 1 sec ── total collision:5582 → total hop:37471 → probability: 0.148969
420
421  bcr:140164372956928 after 519  1011
```

當全部都被 mark 成 clean channel 時每個 device 可在 80 channel 中搶資源，也使 collision probability 降低

(4)(a) bad channel value 設定為全部的碰撞/全部的跳頻

與 3(a)沒有太大的差異，只有 mark 的更精確，可使壅擠頻道被 mark

```
maxhsu@Max-Hsu:/mnt/c/Users/Max-Hsu/Desktop/homework/wireless/hw4/hw4$ ./HW4-1
Marking bad channel 0.409315  device: 40   after: 1 sec   total collision:16136   total hop:39422   probability: 0.409315
method1 bad_channel 0.409315  device: 40   after: 1 sec   total collision:16447   total hop:39289   probability: 0.418616

Marking bad channel 0.572422  device: 80   after: 1 sec   total collision:45286   total hop:79113   probability: 0.572422
method1 bad_channel 0.572422  device: 80   after: 1 sec   total collision:46068   total hop:79077   probability: 0.582571
```

(4)(b) bad channel value 設定為全部的碰撞/全部的跳頻

與 3(b)沒有太大的差異，只有 mark 的更精確，可使壅擠頻道被 mark

```
maxhsu@Max-Hsu:/mnt/c/Users/Max-Hsu/Desktop/homework/wireless/hw4/hw4-2$ ./HW4-2
Marking bad channel 0.401780  device: 40   after: 1 sec   total collision:14493   total hop:36072   probability: 0.401780
method1 bad_channel 0.401780  device: 40   after: 1 sec   total collision:28572   total hop:40570   probability: 0.704264

Marking bad channel 0.573193  device: 80   after: 1 sec   total collision:44920   total hop:78368   probability: 0.573193
method1 bad_channel 0.573193  device: 80   after: 1 sec   total collision:60055   total hop:78550   probability: 0.764545
```