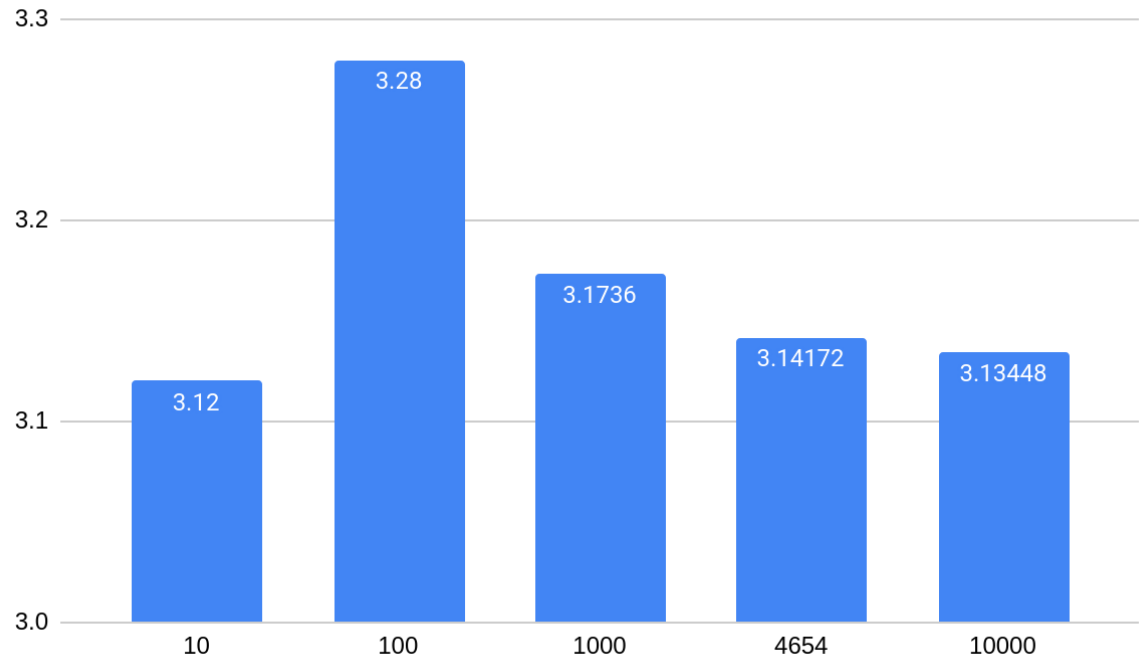
ΜΠΑΛΛΟΥ ΗΒΗ 4739
ΓΚΙΟΥΛΗΣ ΚΩΝΣΤΑΝΤΙΝΟΣ 4654

Μικροεπεξεργαστές:

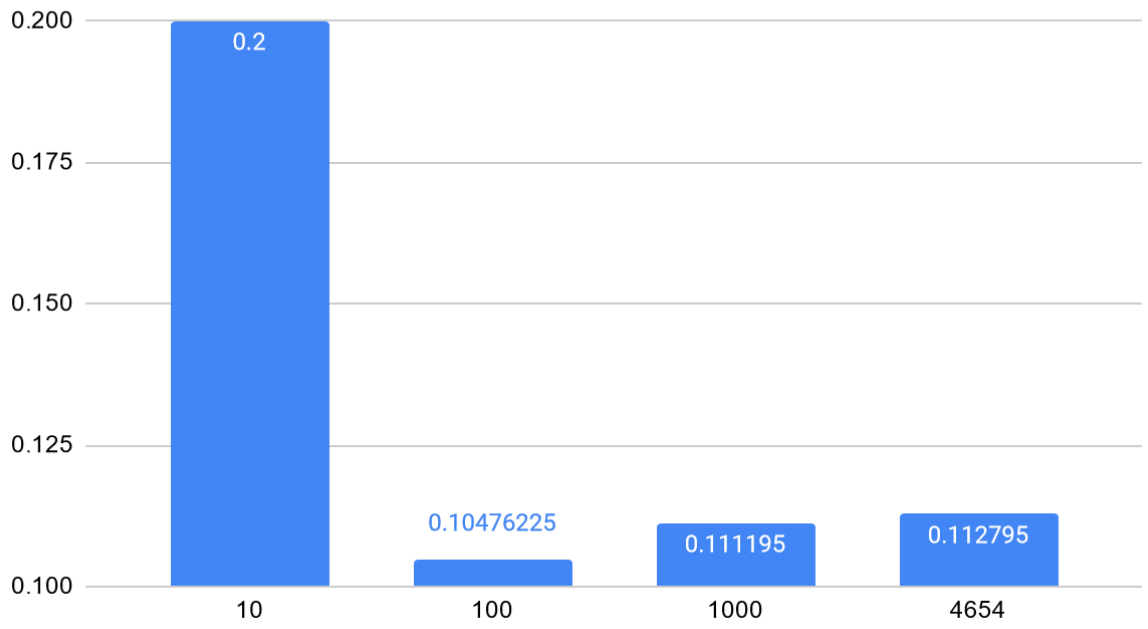
Άσκηση 1.1

Πλήθος εκτ.	1	2	3	4	5	ΜΟ
10	3.2	2	2.8	3.6	4	3.12
100	3.36	3.08	3.28	3.32	3.36	3.28
1000	3.22	3.084	3.212	3.244	3.108	3.1736
4654	3.1964	3.1001	3.1654	3.1208	3.1259	3.14172
10000	3.1704	3.1408	3.1352	3.12	3.106	3.13448



Άσκηση 1.2

	1	2	3	4	MO
10	0.33333	0.2	0.06667	0.2	0.2
100	0.12381	0.047619	0.10476	0.14286	0.10476225
1000	0.10846	0.10448	0.1204	0.11144	0.111195
4654	0.11569	0.11269	0.10668	0.11612	0.112795



Άσκηση 1.3

Παράδειγμα εκτέλεσης :

```
>> signalprobs(0.5,0.5,0.5)
AND Gate for input probabilities (0.500000 0.500000):
Signal Probability = 0.250000
Switching activity Esw = 0.375000
OR Gate for input probabilities (0.500000 0.500000):
Signal Probability = 0.750000
Switching activity Esw = 0.375000
XOR Gate for input probabilities (0.500000 0.500000):
Signal Probability = 0.500000
Switching activity Esw = 0.500000
NAND Gate for input probabilities (0.500000 0.500000):
Signal Probability = 0.750000
Switching activity Esw = 0.375000
NOR Gate for input probabilities (0.500000 0.500000):
Signal Probability = 0.250000
Switching activity Esw = 0.375000
3-input AND Gate for input probabilities (0.500000 0.500000 0.500000):
Signal Probability = 0.125000
Switching activity Esw = 0.218750
3-input OR Gate for input probabilities (0.500000 0.500000 0.500000):
Signal Probability = 0.875000
Switching activity Esw = 0.218750
3-input XOR Gate for input probabilities (0.500000 0.500000 0.500000):
Signal Probability = 0.500000
Switching activity Esw = 0.500000
3-input NAND Gate for input probabilities (0.500000 0.500000 0.500000):
Signal Probability = 0.875000
Switching activity Esw = 0.218750
3-input NOR Gate for input probabilities (0.500000 0.500000 0.500000):
Signal Probability = 0.125000
Switching activity Esw = 0.218750
5-input AND Gate for input probabilities (0.500000 0.500000 0.500000 0.500000 0.500000):
Signal Probability = 0.031250
Switching activity Esw = 0.060547
5-input OR Gate for input probabilities (0.500000 0.500000 0.500000 0.500000 0.500000):
Signal Probability = 0.968750
Switching activity Esw = 0.060547
5-input XOR Gate for input probabilities (0.500000 0.500000 0.500000 0.500000 0.500000):
Signal Probability = 0.500000
Switching activity Esw = 0.500000
5-input NAND Gate for input probabilities (0.500000 0.500000 0.500000 0.500000 0.500000):
Signal Probability = 0.968750
Switching activity Esw = 0.060547
5-input NOR Gate for input probabilities (0.500000 0.500000 0.500000 0.500000 0.500000):
Signal Probability = 0.031250
Switching activity Esw = 0.060547
```

Άσκηση 2.1

Πίνακας αλήθειας:

A	B	C	E	F	D
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	0	1	0
0	1	1	0	0	0
1	0	0	0	1	0
1	0	1	0	0	0
1	1	0	1	1	1
1	1	1	1	0	0

Έξοδος:

```
>> simulateCircuitWithSwitchingActivity(0,0,0)
Input Signals: a=0.000000, b=0.000000, c=0.000000
Intermediate Signals e = 0.000000, f = 1.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(0,0,1)
Input Signals: a=0.000000, b=0.000000, c=1.000000
Intermediate Signals e = 0.000000, f = 0.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(0,1,0)
Input Signals: a=0.000000, b=1.000000, c=0.000000
Intermediate Signals e = 0.000000, f = 1.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(0,1,1)
Input Signals: a=0.000000, b=1.000000, c=1.000000
Intermediate Signals e = 0.000000, f = 0.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(1,0,0)
Input Signals: a=1.000000, b=0.000000, c=0.000000
Intermediate Signals e = 0.000000, f = 1.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000
```

```
>> simulateCircuitWithSwitchingActivity(1,0,1)
Input Signals: a=1.000000, b=0.000000, c=1.000000
Intermediate Signals e = 0.000000, f = 0.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(1,1,0)
Input Signals: a=1.000000, b=1.000000, c=0.000000
Intermediate Signals e = 1.000000, f = 1.000000
Output Signal d = 1.000000
Switching Activity of d = 0.000000

>> simulateCircuitWithSwitchingActivity(1,1,1)
Input Signals: a=1.000000, b=1.000000, c=1.000000
Intermediate Signals e = 1.000000, f = 0.000000
Output Signal d = 0.000000
Switching Activity of d = 0.000000
```

Η εκτέλεση είναι σωστή!

Άσκηση 2.2

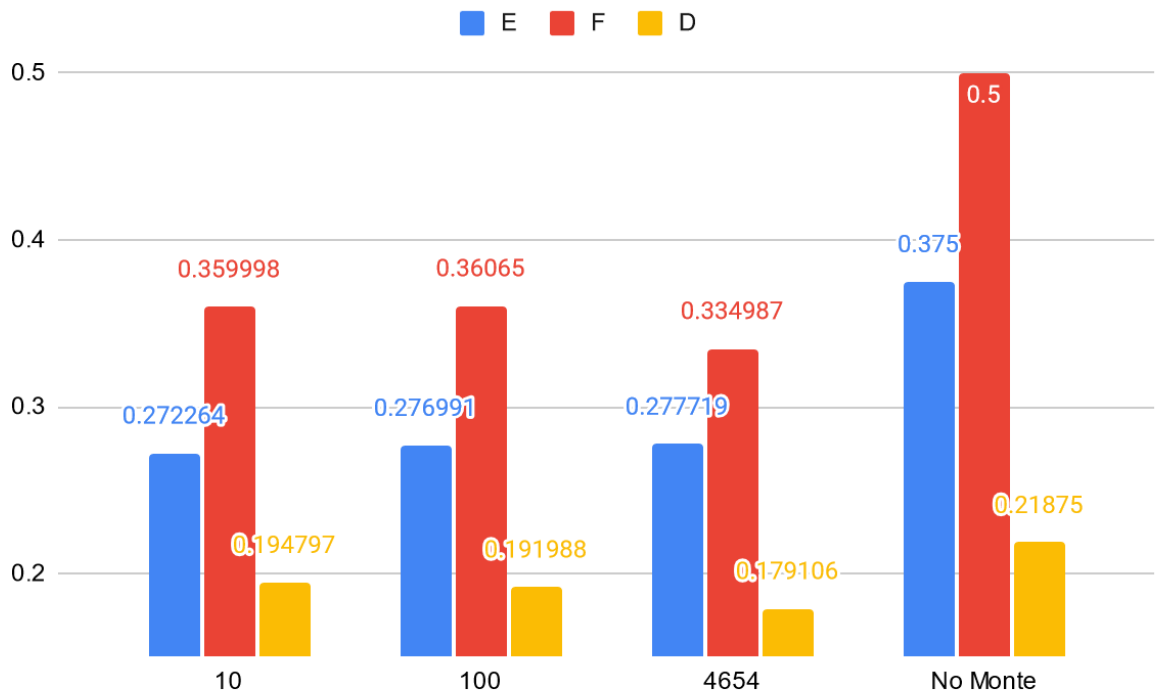
```
>> simulateCircuitWithSwitchingActivity(0.5,0.5,0.5)
Input Signals: a=0.500000, b=0.500000, c=0.500000
Intermediate Signals e = 0.250000, f = 0.500000
Output Signal d = 0.125000
Switching Activity of e = 0.375000
Switching Activity of f = 0.500000
Switching Activity of d = 0.218750
Overall Switching Activity = 0.041016
```

Άσκηση 2.3

```
>> simulateCircuitMonteCarlo(10)
Average Output Signal e = 0.308018
Average Switching Activity of e = 0.272264
Average Output Signal f = 0.488857
Average Switching Activity of f = 0.359998
Average Output Signal d = 0.155642
Average Switching Activity of d = 0.194797
Overall Average Switching Activity 0.019093

>> simulateCircuitMonteCarlo(100)
Average Output Signal e = 0.264064
Average Switching Activity of e = 0.276991
Average Output Signal f = 0.511401
Average Switching Activity of f = 0.360650
Average Output Signal d = 0.140256
Average Switching Activity of d = 0.191988
Overall Average Switching Activity 0.019179
```

```
>> simulateCircuitMonteCarlo(4654)
Average Output Signal e = 0.252342
Average Switching Activity of e = 0.277719
Average Output Signal f = 0.500862
Average Switching Activity of f = 0.334987
Average Output Signal d = 0.127085
Average Switching Activity of d = 0.179106
Overall Average Switching Activity 0.016663
```



Παρατηρούμε πως οι τιμές των προσομοιώσεων με Monte Carlo, είναι κατά 20-35% πιο χαμηλές από τη προσομοίωση χωρίς Monte Carlo.

Άσκηση 3.1
Αποτελέσματα:

```
[ivi@aqua] ./logic circuit_format_2.txt testbench 10000
Truth table verification:
a=0, b=0, c=0 => d=0
a=0, b=0, c=1 => d=0
a=0, b=1, c=0 => d=0
a=0, b=1, c=1 => d=0
a=1, b=0, c=0 => d=0
a=1, b=0, c=1 => d=0
a=1, b=1, c=0 => d=1
a=1, b=1, c=1 => d=0
Average switching activity for outputs
with inputs (a=0.4654, b=0.4654, c=0.4654):
Output d: 0.333
Output e: 0.482
Output f: 0.21
```

3.2
Αποτελέσματα:

```
[ivi@aqua] ./logic circuit_format_2.txt testbench 10000
Inputs declared in 'circuit_format_2.txt':
a = 0, b = 0, c = 0

Truth table verification:
a=0, b=0, c=0 => e=0, f=1, d=0
a=0, b=0, c=1 => e=0, f=0, d=0
a=0, b=1, c=0 => e=0, f=1, d=0
a=0, b=1, c=1 => e=0, f=0, d=0
a=1, b=0, c=0 => e=0, f=1, d=0
a=1, b=0, c=1 => e=0, f=0, d=0
a=1, b=1, c=0 => e=1, f=1, d=1
a=1, b=1, c=1 => e=1, f=0, d=0

Average switching activity for outputs
with inputs (a=0.4654, b=0.4654, c=0.4654):
d: 0.3433
e: 0.4978
f: 0.2024
```

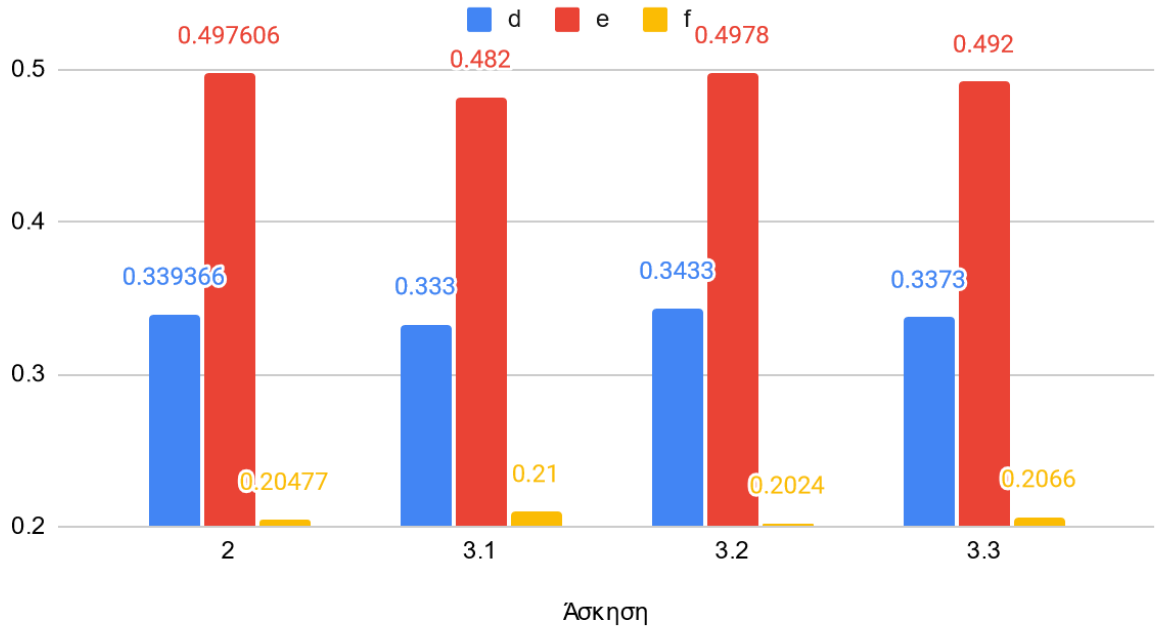
3.3
Αποτελέσματα:

```
[ivi@aqua] ./logic circuit_format_2.txt testbench 10000
Inputs declared in 'circuit_format_2.txt':
a, b, c

Truth table verification:
a=0, b=0, c=0 => e=0, f=1, d=0
a=0, b=0, c=1 => e=0, f=0, d=0
a=0, b=1, c=0 => e=0, f=1, d=0
a=0, b=1, c=1 => e=0, f=0, d=0
a=1, b=0, c=0 => e=0, f=1, d=0
a=1, b=0, c=1 => e=0, f=0, d=0
a=1, b=1, c=0 => e=1, f=1, d=1
a=1, b=1, c=1 => e=1, f=0, d=0

Average switching activity for outputs
with inputs (a=0.4654, b=0.4654, c=0.4654):
d: 0.3373
e: 0.492
f: 0.2066
```

Τέλος, ελέγχουμε το average switching activity κάθε μεθόδου υλοποίησης, καθώς και της αντίστοιχης μεθόδου προσομοίωσης της Άσκησης 2.



Παρατηρούμε πως τα αποτελέσματα είναι σχεδόν ίδια και οι διαφορές εντός των αναμενόμενων ορίων.