Name – Viswanatha Kasyap Pasumarthy

UnityID – 200310870

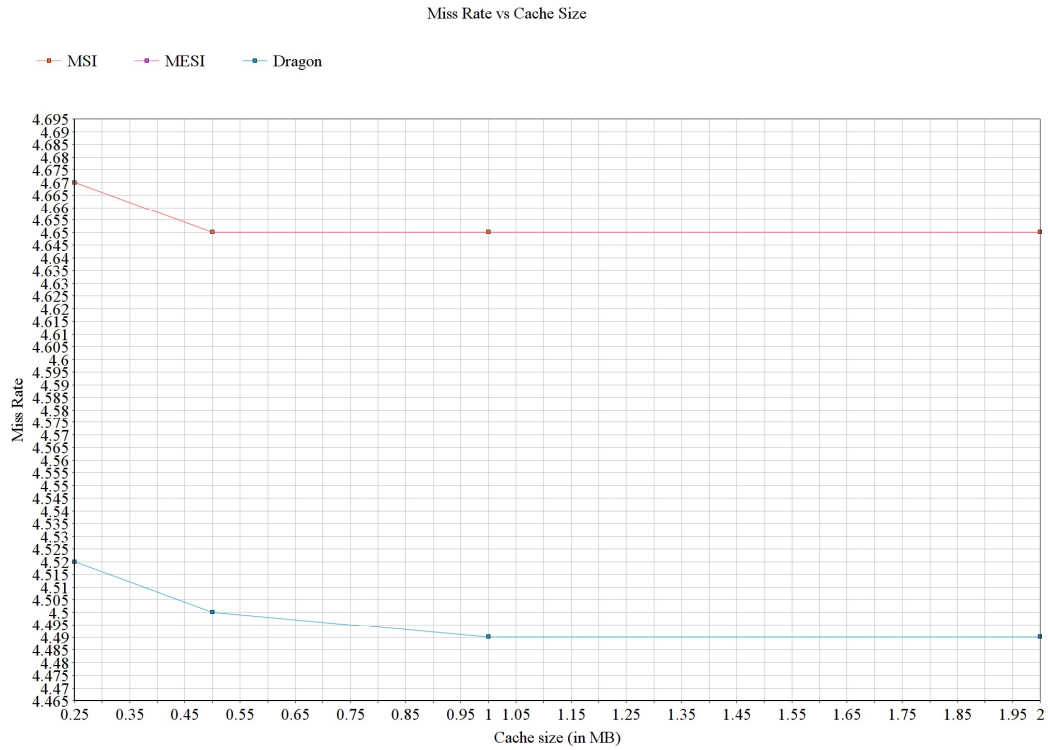
ECE 506 Project 2 – SMP Cache Coherence report

Spreadsheet for all statistics - https://docs.google.com/spreadsheets/d/1S9q1aYMTsWa7EUJRlSxUQoPjKUdvLVh0hL1vnCuU5TU/edit?usp=sharing

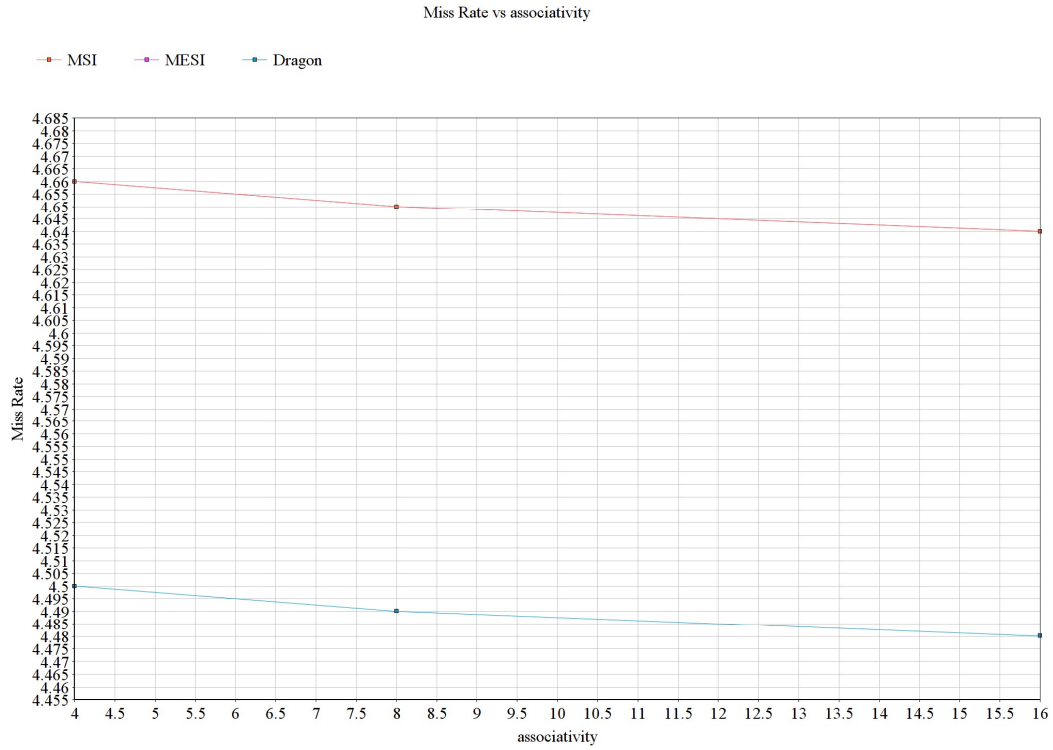
Base observations –

- Many statistics are approximately the same value for both MSI and MESI protocols with the only major difference being in number of memory transactions and number of BusRdXs issued. This is due to the inherent nature of both protocols and the fact that MESI enables us to have Cache-to-cache transactions. While Dragon protocol too allows us to have Cache-to-cache transactions, it hasn't been implemented in this project.
- For a general trend, the miss rate for dragon protocol is observed to be slightly lesser than that of MSI and MESI. This trend is observed across all corresponding caches.
- Since the trends for all the caches are observed to be the same with no deviations, graphs have been plotted only for the Cache 0 statistics of each simulation run. However, a full list of tabulated statistics can be found in the spreadsheet linked above.
- In almost all the cases, there are very few gains to be made by changing the complexity of the cache configuration since all the statistics are not too different from each other. However, given a different trace input or a different number of processors, we could observe varying trends that may clearly favour one configuration over the other.
- Attached below are the graphs for Miss rate and memory transactions vs Cache size, block size, and associativity. The trends observed in these graphs are resonated in all other graphs and it would just be redundant to attach them here.
- Note that in case of Miss rates, the values for MSI and MESI are the exact same as seen from the spreadsheet and thus only one line is shown.
- For a fixed set of cache size, associativity and block size, Dragon protocol has the least miss rate at 4.07%, the least writebacks at 145, and the least flushes at 3. MSI has the least interventions, MESI has the least BusRdX operations. Thus, we can conclusively say that for the given trace input, dragon protocol is the most optimum one if we assume that cache to cache transactions are enabled. If not, MESI would be the most optimum.

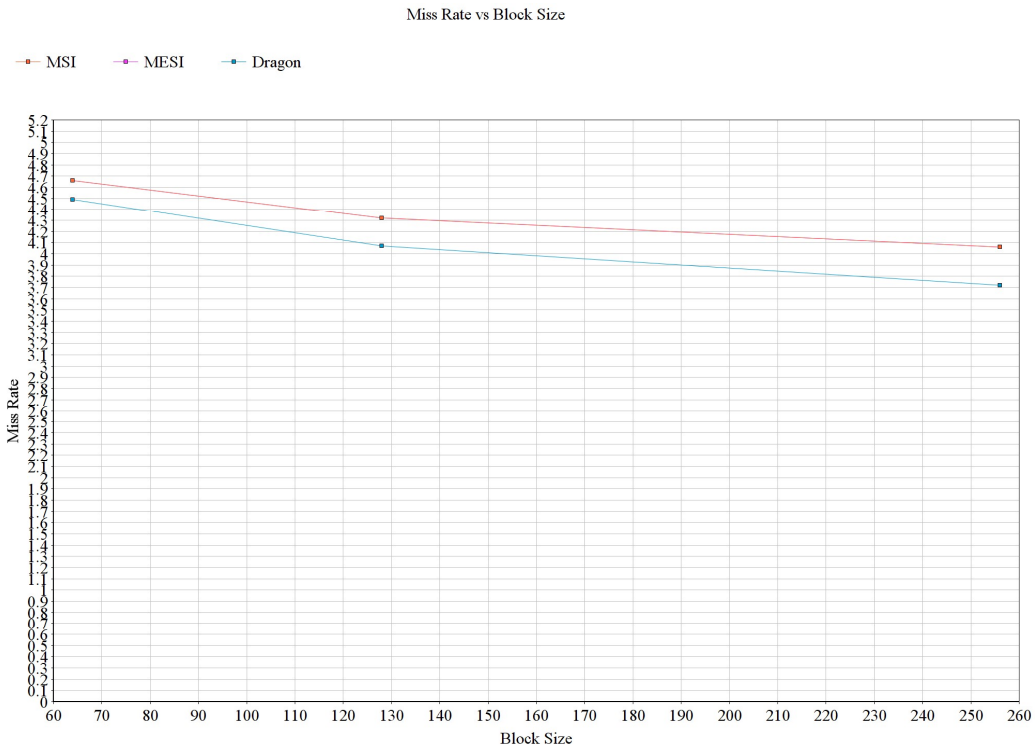
Graph 1.1


Miss Rate vs Cache Size
MSI
MESI
Dragon
Miss Rate
4.695
4.69
4.685
4.68
4.675
4.67
4.665
4.66
4.655
4.65
4.645
4.64
4.635
4.63
4.625
4.62
4.615
4.61
4.605
4.6
4.595
4.59
4.585
4.58
4.575
4.57
4.565
4.56
4.555
4.55
4.545
4.54
4.535
4.53
4.525
4.52
4.515
4.51
4.505
4.5
4.495
4.49
4.485
4.48
4.475
4.47
4.465
0.25 0.35 0.45 0.55 0.65 0.75 0.85 0.95 1 1.05 1.15 1.25 1.35 1.45 1.55 1.65 1.75 1.85 1.95 2
Cache size (in MB)

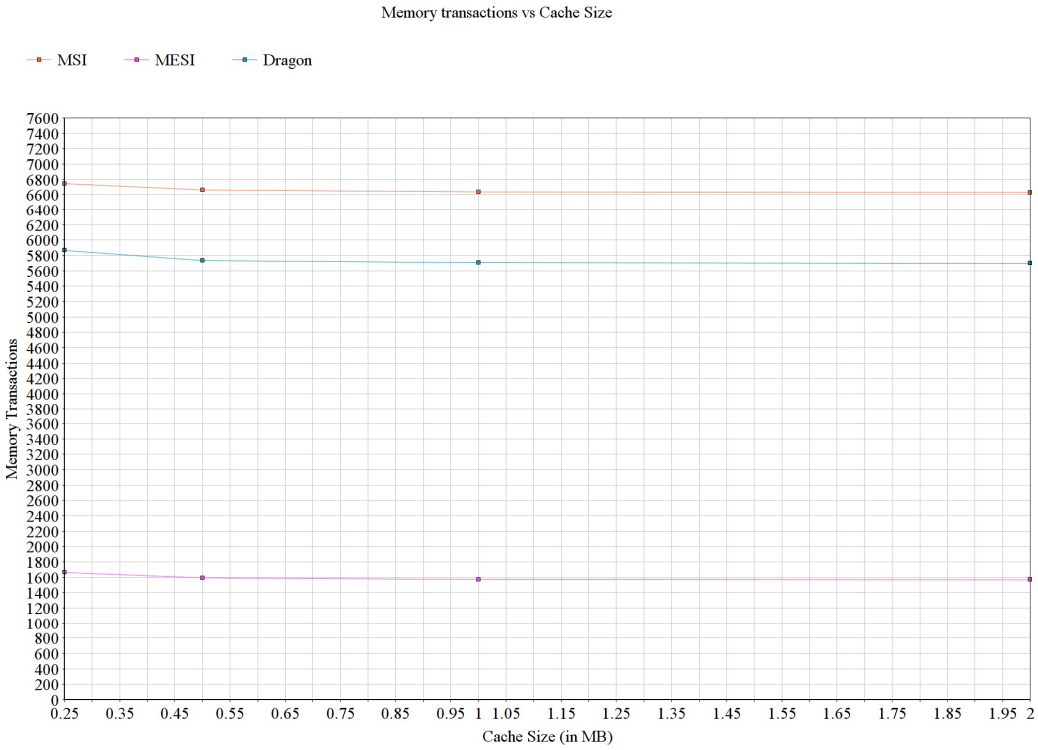
Graph 1.2


Miss Rate vs associativity
MSI
MESI
Dragon
Miss Rate
4.685
4.68
4.675
4.67
4.665
4.66
4.655
4.65
4.645
4.64
4.635
4.63
4.625
4.62
4.615
4.61
4.605
4.6
4.595
4.59
4.585
4.58
4.575
4.57
4.565
4.56
4.555
4.55
4.545
4.54
4.535
4.53
4.525
4.52
4.515
4.51
4.505
4.5
4.495
4.49
4.485
4.48
4.475
4.47
4.465
4.46
4.455
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
15.5
16
associativity

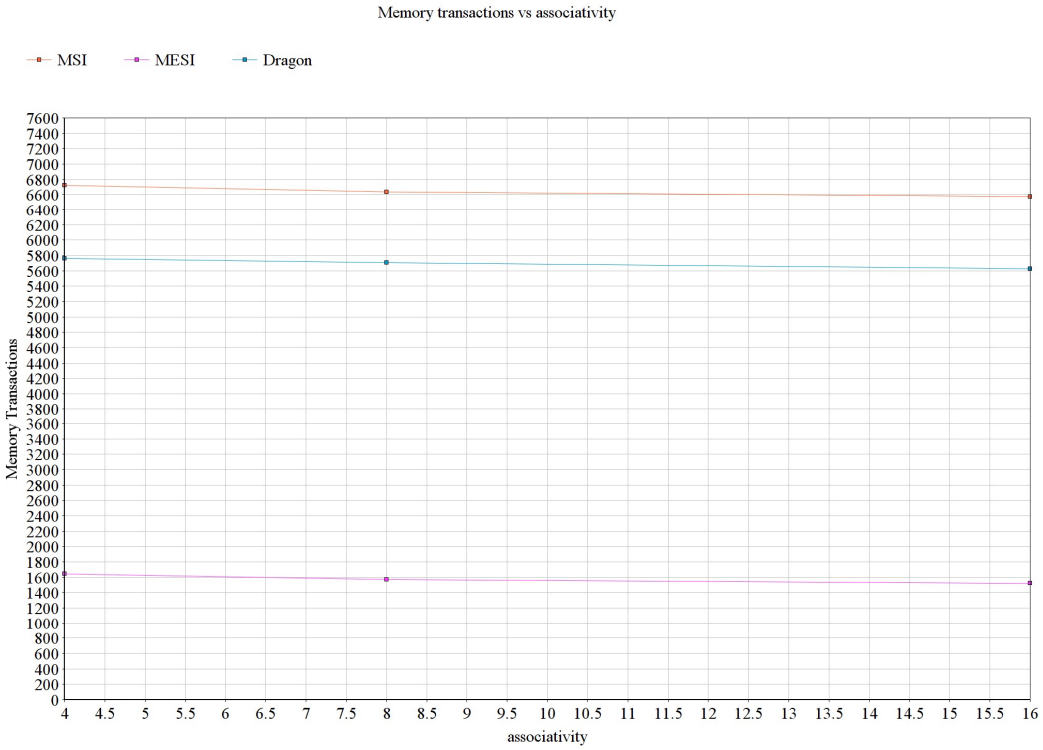
Graph 1.3


Miss Rate vs Block Size
MSI
MESI
Dragon
Miss Rate
Block Size
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260

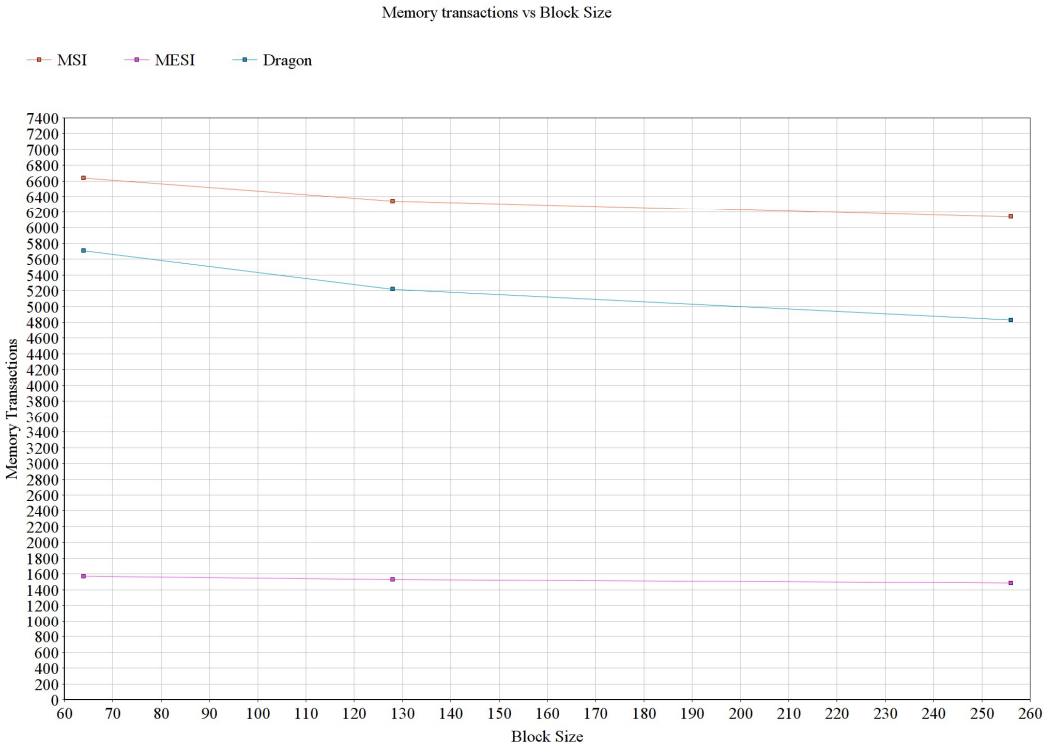
Graph 2.1


Memory transactions vs Cache Size
MSI
MESI
Dragon
Memory Transactions
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.25 0.35 0.45 0.55 0.65 0.75 0.85 0.95 1 1.05 1.15 1.25 1.35 1.45 1.55 1.65 1.75 1.85 1.95 2
Cache Size (in MB)

Graph 2.2


Memory transactions vs associativity
MSI
MESI
Dragon
Memory Transactions
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
15.5
16
associativity

Graph 2.3


Memory transactions vs Block Size
MSI
MESI
Dragon
Memory Transactions
Block Size
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260