

HW4 Conservative Distributed Algorithm

MSIM 406 – Distributed Simulation

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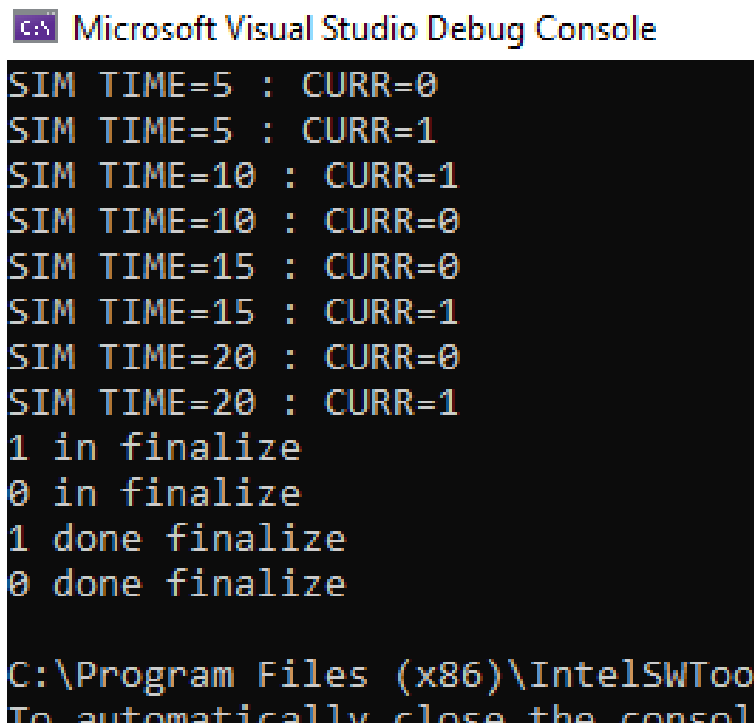
Design

Please see HW4_MSIM406_pseudocode.txt for pseudocode design.

Testing

First test is to see if the simulation will terminate cleanly using just null msgs and lookahead of 5. For this test, I wanted to verify that the simulation will terminate if there are no more non-null msgs in the system. To do this, I initialized the system, set lookahead to 5, then ran the simulation for 20-time-units with 2-, 3-, and 4-processors. The simulation output is below.

Has seen below, the output of the first test was simulation times after null msg execution (each null msg in queue to execute, hence why multiple with same time stamp) and executing process rank (curr=x) where the simulation times stop at 20. This is the correct behavior. Also, this also showed processors not executing events (null msgs) in their past (ascending time).



```
Microsoft Visual Studio Debug Console
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=1
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=0
SIM TIME=15 : CURR=0
SIM TIME=15 : CURR=1
SIM TIME=20 : CURR=0
SIM TIME=20 : CURR=1
1 in finalize
0 in finalize
1 done finalize
0 done finalize

C:\Program Files (x86)\IntelSWToo
To automatically close the consol
```

Figure 1. First Test w/2-processors

```
Microsoft Visual Studio Debu
SIM TIME=5 : CURR=1
SIM TIME=5 : CURR=2
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=1
SIM TIME=5 : CURR=2
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=0
SIM TIME=10 : CURR=2
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=0
SIM TIME=10 : CURR=2
SIM TIME=15 : CURR=1
SIM TIME=15 : CURR=0
SIM TIME=15 : CURR=2
SIM TIME=15 : CURR=2
SIM TIME=15 : CURR=0
SIM TIME=15 : CURR=1
SIM TIME=20 : CURR=2
SIM TIME=20 : CURR=0
SIM TIME=20 : CURR=1
SIM TIME=20 : CURR=0
SIM TIME=20 : CURR=1
SIM TIME=20 : CURR=2
2 in finalize
0 in finalize
1 in finalize
0 done finalize
1 done finalize
2 done finalize
C:\Program Files (x86)\
```

Figure 2. First test with 3 Processors

```
Microsoft Visual Studio Debug Console
SIM TIME=5 : CURR=2
SIM TIME=5 : CURR=3
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=1
SIM TIME=5 : CURR=1
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=2
SIM TIME=5 : CURR=3
SIM TIME=5 : CURR=3
SIM TIME=5 : CURR=2
SIM TIME=5 : CURR=0
SIM TIME=5 : CURR=1
SIM TIME=10 : CURR=2
SIM TIME=10 : CURR=3
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=0
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=0
SIM TIME=10 : CURR=2
SIM TIME=10 : CURR=3
SIM TIME=10 : CURR=0
SIM TIME=10 : CURR=1
SIM TIME=10 : CURR=2
SIM TIME=10 : CURR=3
SIM TIME=15 : CURR=1
SIM TIME=15 : CURR=0
SIM TIME=15 : CURR=2
SIM TIME=15 : CURR=3
SIM TIME=15 : CURR=2
SIM TIME=15 : CURR=3
SIM TIME=15 : CURR=0
SIM TIME=15 : CURR=1
SIM TIME=15 : CURR=3
SIM TIME=15 : CURR=2
SIM TIME=15 : CURR=1
SIM TIME=15 : CURR=0
SIM TIME=20 : CURR=3
SIM TIME=20 : CURR=2
SIM TIME=20 : CURR=0
SIM TIME=20 : CURR=1
SIM TIME=20 : CURR=2
SIM TIME=20 : CURR=3
SIM TIME=20 : CURR=0
SIM TIME=20 : CURR=1
SIM TIME=20 : CURR=3
SIM TIME=20 : CURR=2
SIM TIME=20 : CURR=1
SIM TIME=20 : CURR=0
2 in finalize
3 in finalize
1 in finalize
0 in finalize
2 done finalize
3 done finalize
0 done finalize
1 done finalize
```

Figure 3. First test w/4 processors

Second test is to verify conservative behavior – i.e., events will never be scheduled in the past. To test this, I created a basic test event action (TestEA) which when execute will schedule event to random process with triangular distribution (5, 15, 25) event time. Thus, by initially scheduling multiple TestEAs, the events will propagate through the system with varying times. Also, to test serialization and deserialization of msg events, TestEA will have two state variables, origin process (where it was created) and ID (event identifier).

For the test, I set lookahead to 5, registered TestEA with simulation executive, initially scheduled w/5-TestEAs per processor, and run simulation for 55-time-units with 2- and 4-processors. The figures below are the outputs. Where each output line is execution of event. The line is formatted with event ID: origin process, curr process rank (CURR=), and simulation time on current process.

Has seen in the figures below, the test was a success! If you follow any single process over the course of the simulation, it never goes back in time (no events scheduled in the past).

```

EVENT 38:0 EXEC CURR=1 | TIME=7.195217
EVENT 48:1 EXEC CURR=0 | TIME=6.545991
EVENT 94:1 EXEC CURR=0 | TIME=6.882583
EVENT 55:0 EXEC CURR=1 | TIME=7.264635
EVENT 19:0 EXEC CURR=1 | TIME=7.883813
EVENT 96:1 EXEC CURR=0 | TIME=6.989150
EVENT 31:1 EXEC CURR=0 | TIME=7.174233
EVENT 37:0 EXEC CURR=1 | TIME=7.894565
EVENT 38:0 EXEC CURR=1 | TIME=7.933963
EVENT 91:1 EXEC CURR=0 | TIME=7.840384
EVENT 38:0 EXEC CURR=1 | TIME=14.438952
EVENT 96:1 EXEC CURR=1 | TIME=15.357027
EVENT 38:0 EXEC CURR=0 | TIME=18.418083
EVENT 94:1 EXEC CURR=1 | TIME=19.596656
EVENT 31:1 EXEC CURR=0 | TIME=19.558761
EVENT 37:0 EXEC CURR=1 | TIME=20.155458
EVENT 19:0 EXEC CURR=1 | TIME=20.171695
EVENT 48:1 EXEC CURR=1 | TIME=20.313907
EVENT 91:1 EXEC CURR=0 | TIME=22.614484
EVENT 55:0 EXEC CURR=0 | TIME=24.638470
EVENT 48:1 EXEC CURR=1 | TIME=27.788443
EVENT 19:0 EXEC CURR=0 | TIME=31.466483
EVENT 38:0 EXEC CURR=1 | TIME=31.486825
EVENT 31:1 EXEC CURR=0 | TIME=34.356487
EVENT 94:1 EXEC CURR=1 | TIME=32.795090
EVENT 96:1 EXEC CURR=1 | TIME=34.300656
EVENT 91:1 EXEC CURR=0 | TIME=36.477720
EVENT 37:0 EXEC CURR=0 | TIME=40.482484
EVENT 38:0 EXEC CURR=1 | TIME=37.288951
EVENT 96:1 EXEC CURR=0 | TIME=44.428193
EVENT 55:0 EXEC CURR=1 | TIME=43.912717
EVENT 19:0 EXEC CURR=1 | TIME=44.681058
EVENT 38:0 EXEC CURR=0 | TIME=51.384746
EVENT 48:1 EXEC CURR=1 | TIME=47.841018
EVENT 94:1 EXEC CURR=1 | TIME=48.212616
EVENT 38:0 EXEC CURR=1 | TIME=49.103540
EVENT 91:1 EXEC CURR=1 | TIME=50.059579
EVENT 31:1 EXEC CURR=1 | TIME=50.968065
0 in finalize
EVENT 96:1 EXEC CURR=1 | TIME=54.726320
1 in finalize
0 done finalize
1 done finalize

```

Figure 4. 2nd Test w/2-processors and 5-TestEA/process

EVENT	45:2	EXEC	CURR=3	TIME=7.259860
EVENT	38:0	EXEC	CURR=1	TIME=7.195217
EVENT	55:0	EXEC	CURR=1	TIME=7.264635
EVENT	19:0	EXEC	CURR=1	TIME=7.883813
EVENT	51:3	EXEC	CURR=0	TIME=6.321384
EVENT	75:3	EXEC	CURR=0	TIME=6.809558
EVENT	98:3	EXEC	CURR=0	TIME=7.310176
EVENT	6:2	EXEC	CURR=3	TIME=7.303782
EVENT	58:2	EXEC	CURR=3	TIME=8.050944
EVENT	19:2	EXEC	CURR=3	TIME=8.382119
EVENT	73:2	EXEC	CURR=3	TIME=8.396095
EVENT	48:1	EXEC	CURR=2	TIME=6.545991
EVENT	94:1	EXEC	CURR=2	TIME=6.882583
EVENT	37:0	EXEC	CURR=1	TIME=7.894565
EVENT	38:0	EXEC	CURR=1	TIME=7.933963
EVENT	82:3	EXEC	CURR=0	TIME=7.467458
EVENT	68:3	EXEC	CURR=0	TIME=8.185030
EVENT	96:1	EXEC	CURR=2	TIME=6.989150
EVENT	31:1	EXEC	CURR=2	TIME=7.174233
EVENT	91:1	EXEC	CURR=2	TIME=7.840384
EVENT	38:0	EXEC	CURR=1	TIME=14.438952
EVENT	96:1	EXEC	CURR=2	TIME=14.858761
EVENT	19:2	EXEC	CURR=2	TIME=15.554622
EVENT	98:3	EXEC	CURR=1	TIME=15.678053
EVENT	75:3	EXEC	CURR=1	TIME=19.523631
EVENT	51:3	EXEC	CURR=1	TIME=20.089299
EVENT	37:0	EXEC	CURR=1	TIME=20.155458
EVENT	19:0	EXEC	CURR=3	TIME=20.171695
EVENT	82:3	EXEC	CURR=2	TIME=19.851986
EVENT	38:0	EXEC	CURR=0	TIME=18.418083
EVENT	73:2	EXEC	CURR=3	TIME=22.779309
EVENT	45:2	EXEC	CURR=1	TIME=23.316379
EVENT	55:0	EXEC	CURR=2	TIME=24.638470
EVENT	68:3	EXEC	CURR=0	TIME=22.959130
EVENT	94:1	EXEC	CURR=0	TIME=23.793896
EVENT	48:1	EXEC	CURR=1	TIME=28.398029
EVENT	58:2	EXEC	CURR=0	TIME=25.261862
EVENT	6:2	EXEC	CURR=1	TIME=28.493101
EVENT	31:1	EXEC	CURR=0	TIME=26.545274
EVENT	91:1	EXEC	CURR=0	TIME=26.783228
EVENT	19:0	EXEC	CURR=2	TIME=31.121768
EVENT	45:2	EXEC	CURR=3	TIME=30.790916
EVENT	38:0	EXEC	CURR=1	TIME=31.486825
EVENT	37:0	EXEC	CURR=2	TIME=31.450247
EVENT	75:3	EXEC	CURR=3	TIME=32.722065
EVENT	19:2	EXEC	CURR=1	TIME=33.278185
EVENT	96:1	EXEC	CURR=2	TIME=33.263481
EVENT	98:3	EXEC	CURR=1	TIME=34.621682
EVENT	73:2	EXEC	CURR=1	TIME=34.838360
EVENT	38:0	EXEC	CURR=1	TIME=37.288951
EVENT	94:1	EXEC	CURR=2	TIME=37.657132
EVENT	82:3	EXEC	CURR=0	TIME=34.623247
EVENT	96:1	EXEC	CURR=1	TIME=38.787117
EVENT	31:1	EXEC	CURR=1	TIME=39.759849
EVENT	68:3	EXEC	CURR=0	TIME=37.756856
EVENT	75:3	EXEC	CURR=2	TIME=41.532154
EVENT	91:1	EXEC	CURR=1	TIME=43.394806
EVENT	51:3	EXEC	CURR=0	TIME=40.416324
EVENT	19:2	EXEC	CURR=2	TIME=43.405721
EVENT	55:0	EXEC	CURR=3	TIME=44.465508
EVENT	58:2	EXEC	CURR=1	TIME=44.536109
EVENT	19:0	EXEC	CURR=2	TIME=44.065624
EVENT	6:2	EXEC	CURR=1	TIME=46.109815
EVENT	38:0	EXEC	CURR=1	TIME=46.904351
EVENT	82:3	EXEC	CURR=1	TIME=48.205107
EVENT	48:1	EXEC	CURR=3	TIME=48.450604
EVENT	98:3	EXEC	CURR=2	TIME=48.717476
EVENT	51:3	EXEC	CURR=1	TIME=50.714452
EVENT	96:1	EXEC	CURR=2	TIME=49.830815
EVENT	37:0	EXEC	CURR=1	TIME=52.126682
EVENT	91:1	EXEC	CURR=3	TIME=52.986142
EVENT	73:2	EXEC	CURR=2	TIME=53.185974
1 in finalize				
EVENT	6:2	EXEC	CURR=3	TIME=54.730955
3 in finalize				
2 in finalize				
EVENT	38:0	EXEC	CURR=0	TIME=53.166467
EVENT	94:1	EXEC	CURR=0	TIME=53.442904
EVENT	45:2	EXEC	CURR=0	TIME=53.523979

Figure 5. 2nd Test w/4-processors and 5-TestEA/process