Hw #7 Solution

1) a) iteration 0, Deviation = 0.5, EstRTT = 4.00
All sample RTT = 1.0, $\delta = 1/8$, $\mu = 1.0$, $\phi = 4.0$
Results are shown on page 2 (excel output)

Using a deviation of 1.5 gives results shown on page 3.

b) Use deviation of 0.5, $\delta = 1/4$, Results on Page 4

Formulas: n indicates current iteration #
n-1 indicates previous iteration value

$$Diff_n = Sample_n - EstRTT_{n-1}$$
$$EstRTT_n = EstRTT_{n-1} + \delta Diff_n$$
$$Dev_n = Dev_{n-1} + \delta(|Diff_n| - Dev_{n-1})$$
$$Time\ out = EstRTT_n + 4(Dev_n)$$

Results:

a) i) deviation = 0.5 — 19 iterations
ii) deviation = 1.5 — 20 iterations
b) deviation = 0.5, $\delta = 1/4$ — 10 iterations

Remarks: for part a, initial deviation doesn't have much of an effect on the results.
Comparing parts a and b, it is obvious that δ has a much bigger impact on the timeout value

Homework #7, Problem #1

Deviation = 0.5

delta 0.125

Iteration	Sample RTT	Estimated RTT	Deviation	Difference	Timeout
0	1.0000	4.0000	0.5000		
1	1.0000	3.6250	0.8125	-3.0000	6.8750
2	1.0000	3.2969	1.0391	-2.6250	7.4531
3	1.0000	3.0098	1.1963	-2.2969	7.7949
4	1.0000	2.7585	1.2980	-2.0098	7.9504
5	1.0000	2.5387	1.3555	-1.7585	7.9609
6	1.0000	2.3464	1.3784	-1.5387	7.8602
7	1.0000	2.1781	1.3744	-1.3464	7.6758
8	1.0000	2.0308	1.3499	-1.1781	7.4304
9	1.0000	1.9020	1.3100	-1.0308	7.1420
10	1.0000	1.7892	1.2590	-0.9020	6.8252
11	1.0000	1.6906	1.2003	-0.7892	6.4917
12	1.0000	1.6043	1.1366	-0.6906	6.1505
13	1.0000	1.5287	1.0700	-0.6043	5.8088
14	1.0000	1.4626	1.0024	-0.5287	5.4721
15	1.0000	1.4048	0.9349	-0.4626	5.1444
16	1.0000	1.3542	0.8686	-0.4048	4.8287
17	1.0000	1.3099	0.8043	-0.3542	4.5273
18	1.0000	1.2712	0.7425	-0.3099	4.2413
19	1.0000	1.2373	0.6836	-0.2712	3.9717
20	1.0000	1.2076	0.6278	-0.2373	3.7189
21	1.0000	1.1817	0.5753	-0.2076	3.4829
22	1.0000	1.1590	0.5261	-0.1817	3.2633
23	1.0000	1.1391	0.4802	-0.1590	3.0599

Homework #7, Problem #1

Deviation = 1.5

delta 0.125

Iteration	Sample RTT	Estimated RTT	Deviation	Difference	Timeout
0	1.0000	4.0000	1.5000		
1	1.0000	3.6250	1.6875	-3.0000	10.3750
2	1.0000	3.2969	1.8047	-2.6250	10.5156
3	1.0000	3.0098	1.8662	-2.2969	10.4746
4	1.0000	2.7585	1.8842	-2.0098	10.2952
5	1.0000	2.5387	1.8685	-1.7585	10.0125
6	1.0000	2.3464	1.8272	-1.5387	9.6553
7	1.0000	2.1781	1.7671	-1.3464	9.2466
8	1.0000	2.0308	1.6935	-1.1781	8.8048
9	1.0000	1.9020	1.6107	-1.0308	8.3446
10	1.0000	1.7892	1.5221	-0.9020	7.8775
11	1.0000	1.6906	1.4305	-0.7892	7.4125
12	1.0000	1.6043	1.3380	-0.6906	6.9562
13	1.0000	1.5287	1.2463	-0.6043	6.5138
14	1.0000	1.4626	1.1566	-0.5287	6.0889
15	1.0000	1.4048	1.0698	-0.4626	5.6841
16	1.0000	1.3542	0.9867	-0.4048	5.3010
17	1.0000	1.3099	0.9076	-0.3542	4.9405
18	1.0000	1.2712	0.8329	-0.3099	4.6029
19	1.0000	1.2373	0.7627	-0.2712	4.2881
20	1.0000	1.2076	0.6970	-0.2373	3.9958
21	1.0000	1.1817	0.6359	-0.2076	3.7251
22	1.0000	1.1590	0.5791	-0.1817	3.4753
23	1.0000	1.1391	0.5266	-0.1590	3.2454

Homework #7, Problem #1

Deviation = 0.5

delta	Iteration	Sample RTT	Estimated RTT	Deviation	Difference	Timeout
0.25	0	1.0000	4.0000	0.5000		
	1	1.0000	3.2500	1.1250	-3.0000	7.7500
	2	1.0000	2.6875	1.4063	-2.2500	8.3125
	3	1.0000	2.2656	1.4766	-1.6875	8.1719
	4	1.0000	1.9492	1.4238	-1.2656	7.6445
	5	1.0000	1.7119	1.3052	-0.9492	6.9326
	6	1.0000	1.5339	1.1569	-0.7119	6.1614
	7	1.0000	1.4005	1.0011	-0.5339	5.4050
	8	1.0000	1.3003	0.8510	-0.4005	4.7042
	9	1.0000	1.2253	0.7133	-0.3003	4.0785
	10	1.0000	1.1689	0.5913	-0.2253	3.5341
	11	1.0000	1.1267	0.4857	-0.1689	3.0695
	12	1.0000	1.0950	0.3960	-0.1267	2.6788
	13	1.0000	1.0713	0.3207	-0.0950	2.3542
	14	1.0000	1.0535	0.2584	-0.0713	2.0869
	15	1.0000	1.0401	0.2071	-0.0535	1.8686
	16	1.0000	1.0301	0.1654	-0.0401	1.6916
	17	1.0000	1.0226	0.1315	-0.0301	1.5487
	18	1.0000	1.0169	0.1043	-0.0226	1.4341
	19	1.0000	1.0127	0.0825	-0.0169	1.3425
	20	1.0000	1.0095	0.0650	-0.0127	1.2696
	21	1.0000	1.0071	0.0511	-0.0095	1.2117
	22	1.0000	1.0054	0.0401	-0.0071	1.1659
	23	1.0000	1.0040	0.0314	-0.0054	1.1298

2) how many RTT of 1.0 before one of 4.0 is required to keep time out time above 4.0

$\delta = 1/8$, $\mu = 1$, $\Phi = 4.0$

Results are shown on Page 6

from the excel worksheet, The Sample RTT has to be 4.0 every 6Th or 7Th time

Homework #7, Problem #2

delta 0.125

Iteration	Sample RTT	Estimated RTT	Deviation	Difference	Timeout
0	1.0000	1.2500	0.7500	-0.2500	4.2500
1	4.0000	1.5938	1.0000	2.7500	5.5938
2	1.0000	1.5195	0.9492	-0.5938	5.3164
3	1.0000	1.4546	0.8955	-0.5195	5.0366
4	1.0000	1.3978	0.8404	-0.4546	4.7593
5	1.0000	1.3480	0.7851	-0.3978	4.4883
6	1.0000	1.3045	0.7304	-0.3480	4.2263
7	4.0000	1.6415	0.9761	2.6955	5.5457
8	1.0000	1.5613	0.9342	-0.6415	5.2983
9	1.0000	1.4911	0.8876	-0.5613	5.0416
10	1.0000	1.4297	0.8381	-0.4911	4.7820
11	1.0000	1.3760	0.7870	-0.4297	4.5241
12	1.0000	1.3290	0.7356	-0.3760	4.2716
13	1.0000	1.2879	0.6848	-0.3290	4.0272
14	4.0000	1.6269	0.9382	2.7121	5.3798
15	1.0000	1.5485	0.8993	-0.6269	5.1458
16	1.0000	1.4800	0.8555	-0.5485	4.9018
17	1.0000	1.4200	0.8085	-0.4800	4.6541
18	1.0000	1.3675	0.7600	-0.4200	4.4073
19	1.0000	1.3215	0.7109	-0.3675	4.1651
20	4.0000	1.6564	0.9568	2.6785	5.4837
21	1.0000	1.5743	0.9193	-0.6564	5.2514
22	1.0000	1.5025	0.8762	-0.5743	5.0072
23	1.0000	1.4397	0.8295	-0.5025	4.7575
24	1.0000	1.3847	0.7807	-0.4397	4.5077
25	1.0000	1.3366	0.7312	-0.3847	4.2616
26	1.0000	1.2946	0.6819	-0.3366	4.0222
27	4.0000	1.6327	0.9349	2.7054	5.3722
28	1.0000	1.5537	0.8971	-0.6327	5.1420
29	1.0000	1.4844	0.8542	-0.5537	4.9011
30	1.0000	1.4239	0.8079	-0.4844	4.6557
31	1.0000	1.3709	0.7599	-0.4239	4.4107
32	1.0000	1.3245	0.7113	-0.3709	4.1698
33	4.0000	1.6590	0.9568	2.6755	5.4863
34	1.0000	1.5766	0.9196	-0.6590	5.2550
35	1.0000	1.5045	0.8767	-0.5766	5.0114

3) a) Results using $\alpha = 0.8$ are on Page 8
b) Results using $\alpha = 0.9$ are on Page 9

There are some differences in the timeout times based on these values of α. With smaller α, the timeout time makes bigger transitions from sample to sample.

I ran the spreadsheet down to 300 iterations to see if the timeout time for samples of 5,000 converged to a value.

for $\alpha = 0.8$, the timeout times settled on a repeated pattern after 60 iterations

for $\alpha = 0.9$, the pattern did not settle until 90 iterations.

HW#7, Problem 3

alpha
0.8

Iteration	Sample RTT	Estimated RTT	Timeout
0		1.5000	3.0000
1	1.0000	1.4000	2.8000
2	1.0000	1.3200	2.6400
3	1.0000	1.2560	2.5120
4	1.0000	1.2048	2.4096
5	1.0000	1.1638	2.3277
6	5.0000	1.9311	3.8621
7	1.0000	1.7449	3.4897
8	1.0000	1.5959	3.1918
9	1.0000	1.4767	2.9534
10	1.0000	1.3814	2.7627
11	1.0000	1.3051	2.6102
12	5.0000	2.0441	4.0881
13	1.0000	1.8353	3.6705
14	1.0000	1.6682	3.3364
15	1.0000	1.5346	3.0691
16	1.0000	1.4277	2.8553
17	1.0000	1.3421	2.6842
18	5.0000	2.0737	4.1474
19	1.0000	1.8590	3.7179
20	1.0000	1.6872	3.3743
21	1.0000	1.5497	3.0995
22	1.0000	1.4398	2.8796
23	1.0000	1.3518	2.7037
24	5.0000	2.0815	4.1629
25	1.0000	1.8652	3.7303
26	1.0000	1.6921	3.3843
27	1.0000	1.5537	3.1074
28	1.0000	1.4430	2.8859
29	1.0000	1.3544	2.7087
30	5.0000	2.0835	4.1670

HW#7, Problem 3

alpha
0.9

Iteration	Sample RTT	Estimated RTT	Timeout
0		1.5000	3.0000
1	1.0000	1.4500	2.9000
2	1.0000	1.4050	2.8100
3	1.0000	1.3645	2.7290
4	1.0000	1.3281	2.6561
5	1.0000	1.2952	2.5905
6	5.0000	1.6657	3.3314
7	1.0000	1.5991	3.1983
8	1.0000	1.5392	3.0785
9	1.0000	1.4853	2.9706
10	1.0000	1.4368	2.8736
11	1.0000	1.3931	2.7862
12	5.0000	1.7538	3.5076
13	1.0000	1.6784	3.3568
14	1.0000	1.6106	3.2211
15	1.0000	1.5495	3.0990
16	1.0000	1.4946	2.9891
17	1.0000	1.4451	2.8902
18	5.0000	1.8006	3.6012
19	1.0000	1.7205	3.4411
20	1.0000	1.6485	3.2970
21	1.0000	1.5836	3.1673
22	1.0000	1.5253	3.0505
23	1.0000	1.4727	2.9455
24	5.0000	1.8255	3.6509
25	1.0000	1.7429	3.4858
26	1.0000	1.6686	3.3373
27	1.0000	1.6018	3.2035
28	1.0000	1.5416	3.0832
29	1.0000	1.4874	2.9749
30	5.0000	1.8387	3.6774