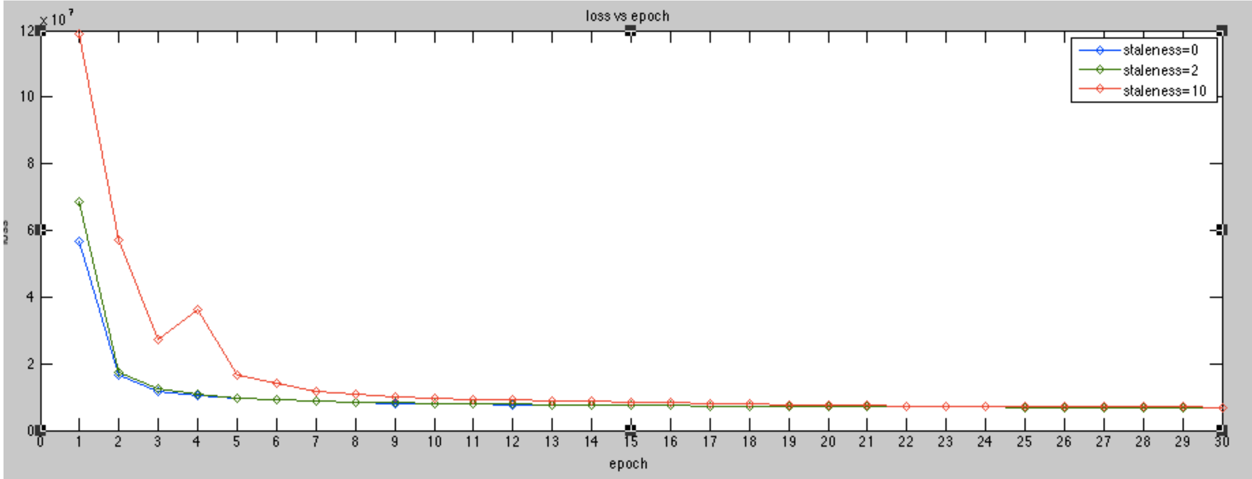
1 Q2

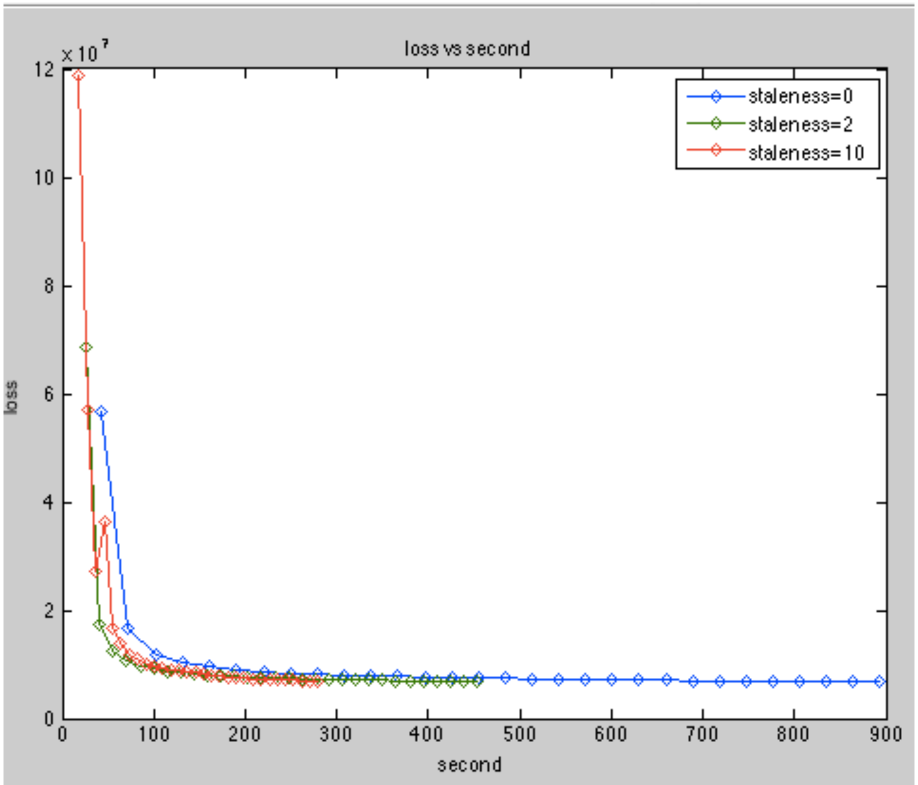
– (Q2a) Which staleness setting converges the fastest per epoch?



staleness=0 and staleness=2 converges fastest per epoch, while staleness=10 is slower.

When staleness is larger, there will be less frequent synchronization, , so one iteration will complete faster. But at the same time, each iteration will be less effective, so when staleness is 10, the decrease of loss per epoch is less than that of stalenss 0 and staleness 2. Thus, it converges lower per epoch when staleness is larger.

– – (Q2b) Which staleness setting converges the fastest per second?

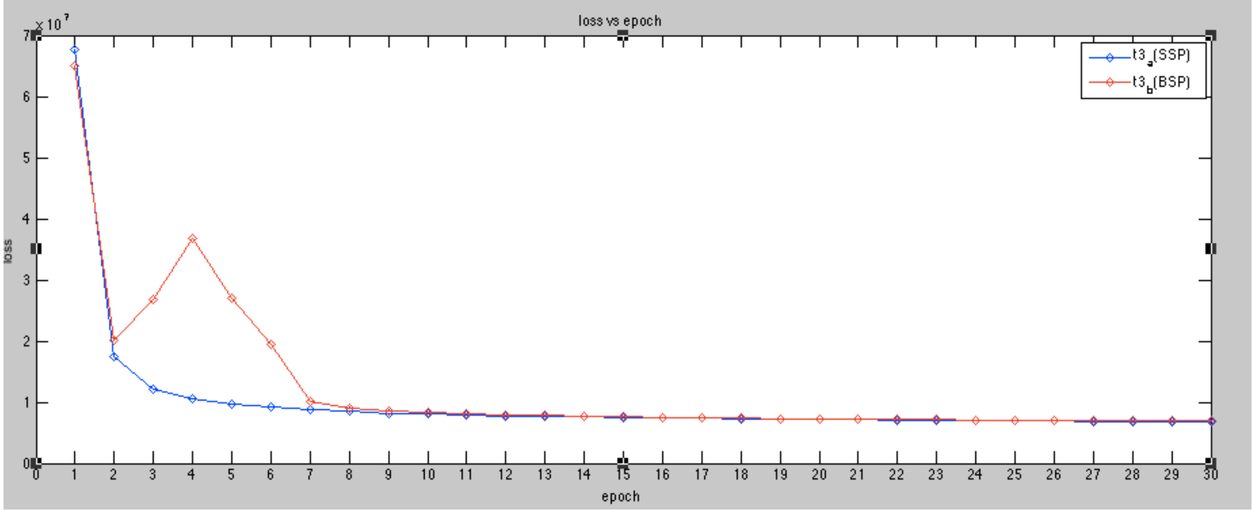


staleness=10 converges fastest per second. To reach the same loss, it only costs about 300s when staleness is 10, while staleness=2 spends 450s and staleness=0 spends 900s.
When staleness is larger, there will be less frequent synchronization, more reading from local views of the shared state, so the one iteration will complete faster. So when three staleness setting all run 30 epoches, the larger staleness will complete faster.
Also, the same as in Q2a, there is a loss increase when staleness is 10, which matches the fact that each iteration will be less effective when staleness is large.

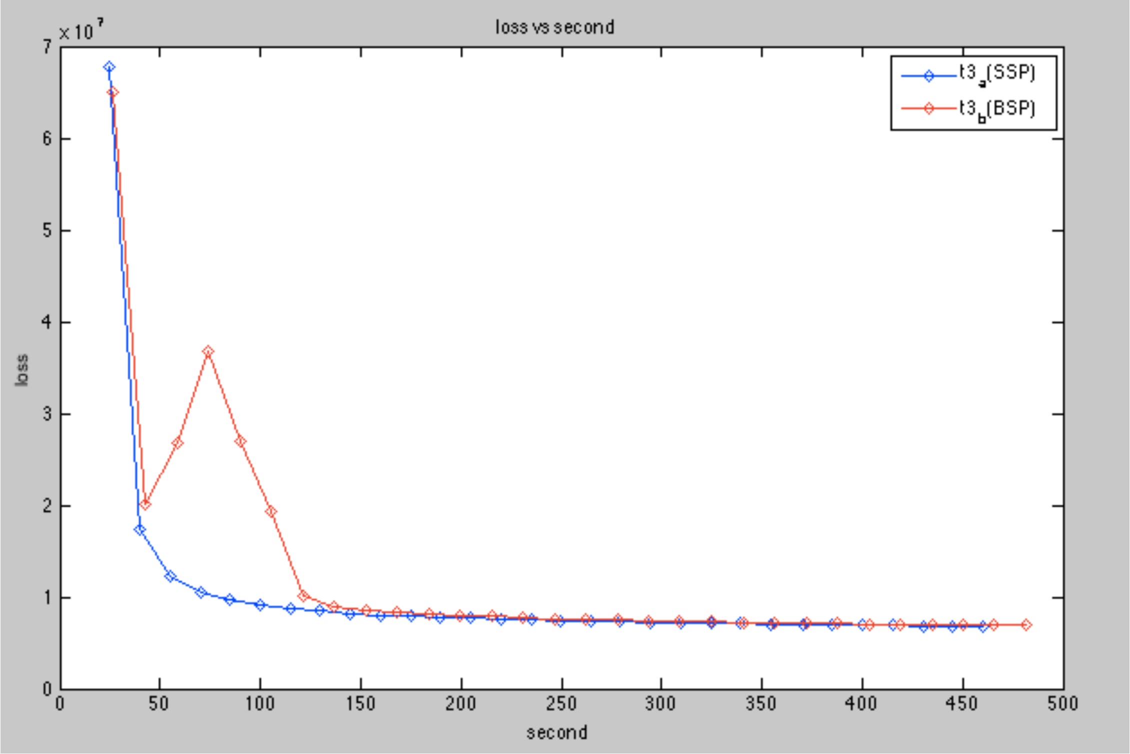
- – (Q2b) If you observe divergence, what do you think is the reason?

2 Q3

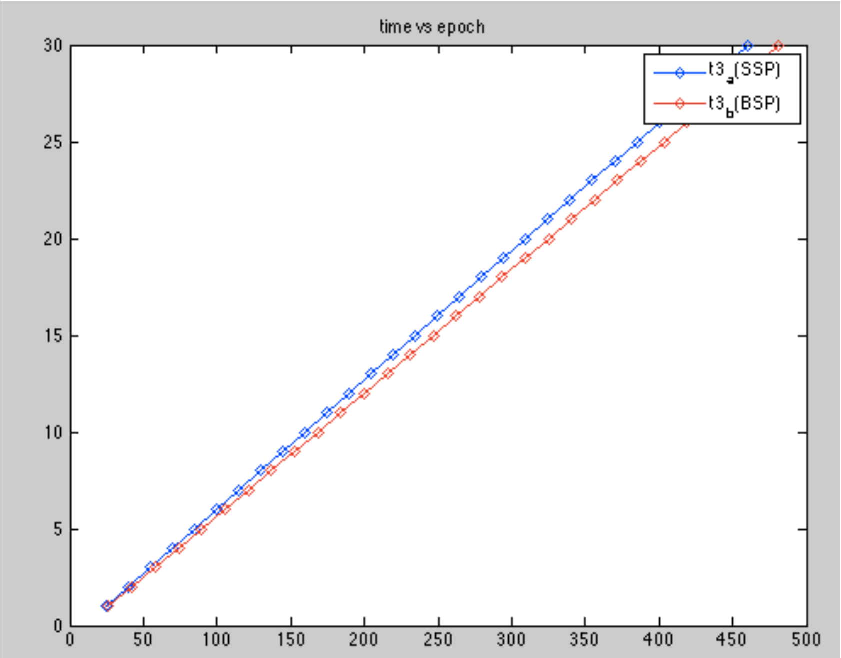
2.1 loss vs epoch



2.2 loss vs second



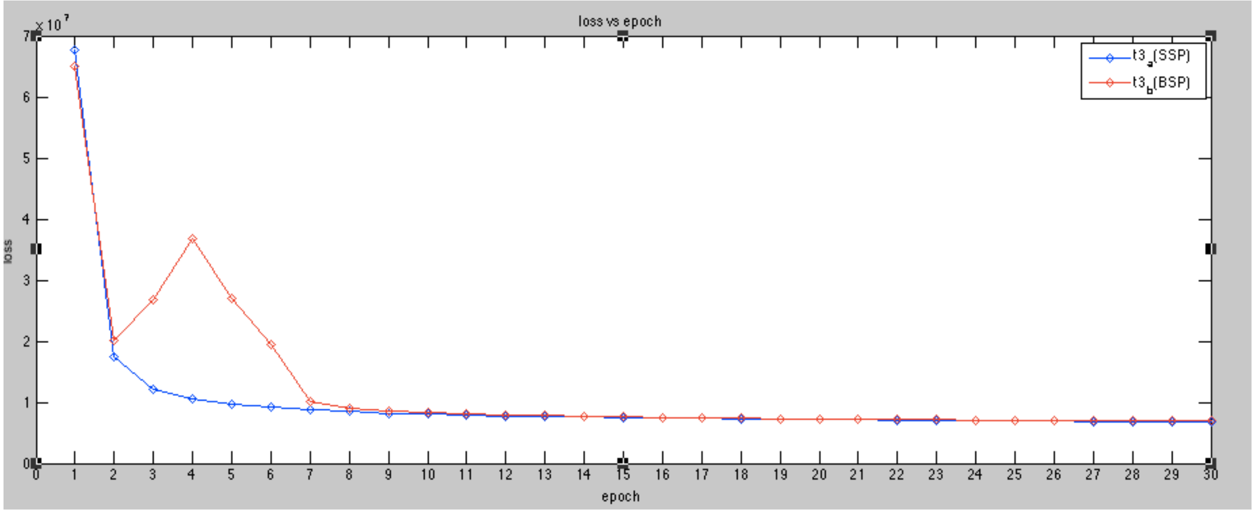
– (Q3a) Which setting, SSP or BSP, has higher throughput (epochs per second)?



From the above figure, we can see that SSP has more epochs per second. As the same reason given in Q2, SPP can run each iteration faster. Thus, it'll complete more epoches per second than BSP.

- (Q3b) Which setting, SSP or BSP, decreases objective faster per epoch?

SSP



From the above figure. we can see that SSP decreases objective faster per epoch.

– (Q3c) Which one, SSP or BSP, converges faster per second?

SSP

From the figure “loss vs second” , we can see that SSP converges a little faster per second.

BSP requires a barrier at the end of each clock, so it is very sensitive to stragglers in the system.

SSP better at dealing with stragglers. But, SSP involves additional communication costs.

When there are no stragglers, BSP can perform a bit better by avoiding this extra communication.

Q4

Q4. Data Movements. [15 pts] In our PS we only move the model (latent factors), but fix the data (movie ratings) on the workers. Let’s say we have P servers and P workers on 2P nodes. Consider 1 unit of model parameters split across P servers such that each server has ^{1} P data. Answer the followings:

– (Q4a) If each worker node needs the full model parameters, how many units of network traffic is each server machine in one model broadcast?

1 units. Each server has 1/p unit data. Each worker need P unit parameters. So in one broadcast, each server will have to send its parameters to each worker. So each server will send 1/p * p = 1 unit.

– (Q4b) If each worker only needs $^{1/p}$ unit of parameters (which can P happen if data is sparse and thus $^{1/p}$ dataset need a partition of the P parameters), how many units of network traffic does each server has in one model broadcast?

1/p unit. Each server has 1/p unit data. Each worker need 1/P unit parameters. So in one broadcast, each server will have to send its parameters to one worker. So each server will send 1/p * 1 = 1/p unit.

Q5

- (Q5a) How often, in hours, should we need to perform checkpoint with 4 machines?

A per-machine MTBF is 1 year, there are 4 machines. So MTBF is 1/4.

And suppose 1 year has 365 days and 24 hours per day. Then:

Interval=sqrt(2*0.1*1/4*24*365) = 20.92844953645635 hours

- (Q5b) Do we need to checkpoint any of the experiments you've run so far?

No. Because all the experiments I run cost less than 1000 seconds. So there is no need to checkpoint.

- (Q5c) MapReduce essentially checkpoint at every phase. According to this approximation, do you think it's necessary in most use cases?

It depends. If there are a lot of machines and the interval may be small. Thus, the run time of each phase may be larger than the interval. In this case, it's necessary to checkpoint every pharse. Otherwiwe, it's not necessary.

Q6. Answer the questions in the collaboration policy on page 1.

Discussed about the meaning of the question 2 with a classmate. But no discussion about the answers.