Problem Set 4, Part I

Problem 1: Replication

1-1) 11 copies of each item, fully distributed locking

voting scheme	***would it work? (ye\s/no)***	***explanation***
1a) update 6 read 5	no	because requires r > n - w, n = 11, w = 6, so r should > 11 - 6 = 5, but r = 5 not > 5
1b) update 5 read 8	no	because requires w > n/2, n = 11, w > 11/2 = 5.5, but w = 5 < 5.5
1c) update 8 read 4	yes	because requires w > n/2 and r > n - w n = 11, w > 11/2 = 5.5, w = 8 > 5.5, r > n - w = 11 - 8 = 3, r = 4 > 3
1d) update 3 read 10	no	because requires w > n/2, n = 11, w > 11/2 = 5.5, but w = 3 < 5.5

1-2) 11 copies of each item, primary-copy locking

voting scheme	***would it work? (yes/no)***	***explanation***
2a) update 6 read 5	no	6 + 5 = 11
2b) update 5 read 8	yes	5 + 8 = 13 > 11
2c) update 8 read 4	yes	8 + 4 = 12 > 11
2d) update 3 read 10	yes	3 + 10 =13 > 11

1-3)

1c) fully distributed locking; update 8 copies, read 4 copies
because it requires the least r. Also, for primary-copy locking, if a site goes down, operations are blocked on all items for which it holds the primary copy, so fully distributed locking is better

1-4)

2d) primary-copy locking; update 3 copies, read 10 copies
because it requires the least w, and update 3 copies, read 10 copies is not valid for fully distributed locking, so we can only do primary-copy locking

Problem 2: Distributed locking with update locks

inequality for global exclusive locks: $x > n/2$
explanation: no two txns can both acquire a global exclusive lock at the same time

inequality for global shared locks: $s > \max(n - x, n - u)$
explanation: we can still apply updated lock after shared lock
and we can also apply the other shared lock after one shared lock, so don't need any upper limitation for s, but no shared locks can be applied after exclusive lock or updated lock

inequality for global update locks: $u > n/2$
explanation: no two txns can both acquire a global updated lock at the same time