

Problem Set 4, Part I

Problem 1: Replication

1-1) 7 copies of each item, fully distributed locking

<i>voting scheme</i>	<i>would it work? (yes/no)</i>	<i>explanation</i>
1a) update 6 read 3	yes	<ul style="list-style-type: none">• if one txn has a global shared lock, no one else can get a global exclusive lock and vice versa.• two txns can both get a global shared lock at the same time.
1b) update 2 read 6	no	<ul style="list-style-type: none">• problem: more than one txn can get a global exclusive lock at the same time.
1c) update 5 read 2	no	<ul style="list-style-type: none">• problem: if one txn has a global shared lock, someone else can get a global exclusive lock.• problem: if one txn has a global exclusive lock, someone else can get a global shared lock.
1d) update 4 read 5	yes	<ul style="list-style-type: none">• if one txn has a global shared lock, no one else can get a global exclusive lock and vice versa.• no two or more txn can hold a global exclusive lock at the same time.
1e) update 3 read 4	no	<ul style="list-style-type: none">• problem: if one txn has a global shared lock, someone else can get a global exclusive lock.• problem: if one txn has a global exclusive lock, someone else can get a global shared lock.• problem: more than one txn can get a global exclusive lock at the same time.

1-2) 7 copies of each item, primary-copy locking

voting scheme	would it work? (yes/no)	explanation
2a) update 6 read 3	yes	<ul style="list-style-type: none">• $r = 3 > n - w = 7 - 6 = 1$
2b) update 2 read 6	yes	<ul style="list-style-type: none">• $r = 6 > 7 - 2 = 5$
2c) update 5 read 2	no	<ul style="list-style-type: none">• $r = n - w$
2d) update 4 read 5	yes	<ul style="list-style-type: none">• $5 > 7 - 4 = 3$
2e) update 3 read 4	no	<ul style="list-style-type: none">• $r = n - w$

Problem 2: Workload-based configurations

2-1)

Configuration 1(a) or 2(a) would be the most preferable because it avoids the need to obtain more shared locks than strictly necessary. Also, the configuration works well for both fully distributed locking and primary-copy locking.

Configuration 1(d) aka 2(d) would be also preferable because the constraints are satisfied, but we might prefer to make x larger so that s can be smaller.

2-2)

If the workload primarily involves writes, the configuration that ensures a higher level of consistency in write operations is generally preferable. Once again, configuration 1(a) would be the most suitable choice.