Problem 1:

a)

- RC and ACA.
- T2 reads page a which is already locked by T1
- To be in class RC, T1 has to be committed before T2
- But here c1 comes before c2, thus s1 belongs to class RC
- Again, T2 reads a after T1 committed
- s1 also belongs to class ACA.
- But in T2 write operation on 'a' comes before c1, so it's not in class ST

b)

- ACA and ST
- T2 reads c after write operation of T1 and read 'b' after read operation of T1.
- T3 read 'a' after T2 and 'b' after T2.
- So, to be in class RC, commit order should be c1, c2 then c3 which is true for s1.
- Thus, s1 belongs to class RC.
- T2 reads c from T1 before T1 commits.
- Hence, s2 doesn't belongs to class ACA as well as ST.

c)

- None
- In this case, T1 reads c after T2 but commits before T2.
- So, s3 does not belong to class RC
- s3 also can not belong class ACA and ST.

Problem 3:

Source code did not submit.

Solution:

==== S1 ====
s1 = [w_1(x), r_2(x), w_3(y), r_1(y), r_3(z), w_1(x), c_1, w_2(y), c_2, w_3(y), c_3]

Immediate restart = wl_1(x), w_1(x), rl_2(x)*, wl_3(y), w_3(y), rl_1(y)*, rl_3(z), r_3(z), w_3(y), wu_3(y), ru_3(z), **c_3**, rl_1(y), r_1(y), w_1(x), wu_1(x), ru_1(y), **c_1**, wl_2(y), w_2(y), wu_2(y) **c_2**

T3 T1 T2

Wait die = wl_1(x), w_1(x), rl_2(x)*, wl_3(y), w_3(y), rl_1(y)*, rl_3(z), r_3(z), w_1(x), w_3(y), wl_2(y), w_2(y), rl_1(y), r_1(y), wu_3(y), ru_3(z), **c_3**, wu_2(y) **c_2**, wu_1(x), ru_1(y), **c_1**

T3 T2 T1

Wound wait = wl_1(x), w_1(x), rl_2(x)*, wl_3(y), w_3(y), rl_1(y)*, rl_3(z), r_3(z), wl_2(y)*, w_3(y), w_1(x), wl_2(y), w_2(y), rl_2(x), r_2(x), wu_3(y), ru_3(z), **c_3**, wul_1(x)*, **c_1**, , wu_2(y), **c_2**

T3 T1 T2

Problem 4:

a) Additional lock modes in addition with Shared (S) and Exclusive (X) locks:
    a. Intention Shared (IS)

b. Intention Exclusive (IX)
c. Shared and Intention Exclusive (SIX)
d. Compatibility matrix (known):

	NL	S	X	IS	IX	SIX
NL	+	+	+	+	+	+
S	+		-	+	-	-
X	+	-	-	-	-	-
IS	+	+	-	+	+	+
IX	+	-	-	+	+	-
SIX	+	-	-	+	-	-