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Database Systems

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Exercise 6

Hand-in: 21.12.2025 (11:59 pm)

Solving the Exercises: The exercises must be solved in groups of three people. Use the notations introduced in the lecture. Please choose the same partners for exercises and project. The DMI plagiarism guidelines apply for this lecture.

Submission Information: Please upload your solutions BEFORE the deadline to ADAM using the team hand-in feature. Solutions that are handed in too late cannot be considered. The use of the exercise template, located in "Exercise Material", is mandatory.

Task 1: Conflict Serializability (12 points)

You are given various schedules with the transactions $T^1, \ldots, T^n$. Denote for each schedule S_i, whether it is conflict serializable. If yes, give at least one equivalent serial schedule. If not, why not? What does the corresponding dependency graph look like?

a) You are given the following schedule S_1 of the transactions T^1, T^2 and T^3:

$$S_1 = \langle\ w_1^1(a)\ w_1^2(a)\ C^2\ w_1^3(b)\ C^3\ w_2^1(b)\ C^1\ \rangle$$

(4 points)

b) You are given the following schedule S_2 of the transactions T^1, T^2, T^3 and T^4:

$$S_2 = \langle\ r_1^1(v)\ r_1^2(w)\ w_2^1(v)\ r_1^3(w)\ r_2^2(x)\ w_2^3(y)\ w_3^2(x)\ r_1^4(y)\ w_3^3(z)\ C^1\ C^2\ C^3\ A^4\ \rangle$$

(4 points)

c) You are given the following schedule S_3 of the transactions T^1, T^2, T^3, T^4 and T^5:

$$S_3 = \langle\ r_1^1(v)\ r_1^2(w)\ w_2^1(w)\ C^1\ w_1^3(x)\ C^3\ w_2^2(x)\ w_3^2(y)\ C^2\ r_1^4(v)\ w_2^4(x)\ w_1^5(x)$$
$$w_2^5(y)\ C^5\ w_3^4(v)\ C^4\ \rangle$$

(4 points)

Task 2: Order Preserving Serializability $\qquad$ (12 points)

Consider the following transactions:

$$T^1 = \langle\; r_1^1(a)\; r_2^1(c)\; r_3^1(b)\; w_4^1(d)\; C^1 \;\rangle$$

$$T^2 = \langle\; r_1^2(b)\; r_2^2(a)\; w_3^2(c)\; w_4^2(b)\; C^2 \;\rangle$$

$$T^3 = \langle\; r_1^3(a)\; w_2^3(d)\; r_3^3(d)\; w_4^3(d)\; C^3 \;\rangle$$

Are the following schedules in CPSR, OPSR and/or COPSR? Reason your decision.

a) $\quad$ $S_4 = \langle\; r_1^2(b)\; r_1^1(a)\; r_2^2(a)\; r_1^3(a)\; w_2^3(d)\; w_3^2(c)\; r_2^1(c)\; r_3^3(d)\; w_4^2(b)\; C^2\; r_3^1(b)\; w_4^1(d)$
$\quad$ $C^1\; w_4^3(d)\; C^3 \;\rangle$

$\qquad$ **(4 points)**

b) $\quad$ $S_5 = \langle\; r_1^2(b)\; r_1^1(a)\; r_2^2(a)\; w_3^2(c)\; w_4^2(b)\; C^2\; r_1^3(a)\; r_2^1(c)\; r_3^1(b)\; w_4^1(d)\; C^1\; w_2^3(d)\; r_3^3(d)$
$\quad$ $w_4^3(d)\; C^3 \;\rangle$

$\qquad$ **(4 points)**

c) $\quad$ $S_6 = \langle\; r_1^1(a)\; r_1^2(b)\; r_2^2(a)\; r_2^1(c)\; w_3^2(c)\; r_3^1(b)\; w_4^2(b)\; C^2\; r_1^3(a)\; w_2^3(d)\; r_3^3(d)\; w_4^3(d)$
$\quad$ $C^3\; w_4^1(d)\; C^1 \;\rangle$

$\qquad$ **(4 points)**

Task 3: Serializability and Recoverability $\qquad$ (6 points)

Analyse the following schedules (S_7 and S_8) and justify whether or not they are an element of

$\qquad$ 1. CPSR, 2. RC, 3. ACA, 4. ST, and / or 5. RG?

a) $S_7 = \langle\; r_1^2(a)\; r_1^1(b)\; w_2^1(b)\; r_3^1(a)\; r_4^1(b)\; C^1\; r_1^3(c)\; r_2^3(b)\; w_2^2(a)\; w_3^2(b)\; C^2\; r_3^3(a)\; C^3 \;\rangle$

$\qquad$ **(3 points)**

b) $S_8 = \langle\; r_1^3(b)\; r_1^1(a)\; r_1^4(a)\; w_2^4(a)\; C^4\; r_2^3(a)\; w_3^3(b)\; r_1^2(b)\; w_2^1(c)\; C^1\; r_2^2(c)\; w_3^2(b)\; r_4^3(b)\; C^3\; A^2 \;\rangle$

$\qquad$ **(3 points)**