

**CSC 432: Database Management**  
**Final**  
**100 points**

25 November 1996, 10:15–11:05 AM

June 20, 2000

**Instructions**

If you finish early, please try to remain seated or move out discreetly so as not to disturb others.

This quiz is closed-book. However, a one-page crib sheet (in addition to your previous crib-sheets) may be used. Crib sheets may not be shared. Collusion or cheating of any form is forbidden. You can be asked to explain your solutions verbally.

There are no trick questions in this quiz. If you think there is some ambiguity, state additional assumptions, but be prepared to justify the need for them. If you are unable to produce a formal answer, give an English description for partial credit.

**1 Transactions**

Consider the following schedule involving transactions  $T_1$ ,  $T_2$ , and  $T_3$ , which access data items  $x$  and  $y$ . Here  $r_i(x)$  means  $T_i$  reads item  $x$  and  $w_i(x)$  means  $T_i$  writes item  $x$ .

$T_1$	$T_2$	$T_3$	$x$	$y$
Initially			5	6
		$r_3(x)$	—	—
	$r_2(x)$		—	—
	$w_2(x)$			—
	$r_2(y)$		—	—
	$w_2(y)$		—	
$r_1(y)$			—	—
$w_1(y)$			—	
		$r_3(y)$	—	—
		$w_3(x)$		—
		$w_3(y)$	—	

- (5 points) Let  $x = 5$  and  $y = 6$  initially.  $T_1$  adds 10 to  $x$  and  $y$ ;  $T_2$  adds 20 to  $x$  and  $y$ ; and  $T_3$  adds 30 to  $x$  and  $y$ . Fill in the blanks (with values of  $x$  and  $y$  after each  $w$  operation).
- (10 points) What problem, if any, is apparent from the values in part ???
- (25 points) Is the above schedule serializable? If so, show an equivalent serial schedule; if not, prove show not. Use the definition of serializability. Do *not* argue based on the values you obtained in part ??.

## 2 Calculus to SQL

Consider the following tuple relational calculus expression on the *Dream Home* database.

$$\{p.pno \mid \text{Property}(p) \wedge (\forall v_1, v_2 : (\text{Viewing}(v_1) \wedge \text{Viewing}(v_2) \wedge v_1.pno = p.pno \wedge v_2.pno = p.pno) \rightarrow v_1.rno = v_2.rno)\}$$

- (20 points) Give an English translation of the above expression, e.g., “Find ...”
- (20 points) Give an SQL query equivalent to the above expression—follow the formula, not the English translation.  
(15 points for correctness; 5 points for elegance.)

### 3 Conceptual to Logical Model

Following the *Dream Home* database, consider the entities: *Staff*, *Owner*, and *Renter* related through a single relationship, *Rents*. In relationship *Rents*, the cardinality of *Staff*, *Owner*, and *Renter* is Many, Many, and 1, respectively. (Picture on the board.)

- (20 points) Assuming that each property is owned by a single owner, convert the above conceptual model to a logical model. (Draw an ER diagram of the logical model with the cardinalities shown.)