CMSC 424–0101 Fall 2002  Quiz 01 (37 points, 30 minutes)  Thu, 03 Oct 2002
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Name: ________________________________

This quiz is open book, open notes, but there can be no sharing of any material. Some
questions in this quiz use the database schema (and sample instance) depicted below. The
columns MPix, MaxAp, and Price are of type real. The columns Rating, RDate, and Desc are
of types, respectively, integer, date, and CLOB. All other columns are of type varchar(30).
When asked for relational algebra or SQL expressions of queries, you must provide answers
that work for all possible database instances, not just the example instance depicted below.
Do not assume any constraints other than the key constraints implied by the underlined
attributes. For brevity, relational algebra expressions abbreviate the schemas of the DigiCams,
Catalog, and Reviews tables as $D(M, L, P, A)$, $C(S, M, L, P)$, and $R(S, T, M, L, R, D)$, respectively.

<table>
<thead>
<tr>
<th>DigiCams</th>
<th>Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Model</td>
</tr>
<tr>
<td>Canon</td>
<td>G3</td>
</tr>
<tr>
<td>Canon</td>
<td>G2</td>
</tr>
<tr>
<td>Nikon</td>
<td>4500</td>
</tr>
<tr>
<td>Olympus</td>
<td>4040</td>
</tr>
<tr>
<td>Olympus</td>
<td>3030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
</tr>
<tr>
<td>Photo Life</td>
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<tr>
<td>Photo Life</td>
</tr>
<tr>
<td>PC Mag</td>
</tr>
</tbody>
</table>

1. (1 pt) Write your name in the space provided above.

2. (3 × 3 pts) Exhibit the results of evaluating each of the following SQL queries on the
above database instance.

(a) select * from Catalog where price < 600;
(b) select M1.Manufacturer, M2.Manufacturer
    from DigiCams M1, DigiCams M2
    where M1.Manufacturer <> M2.Manufacturer and
      M1.manufacturer > 'Minolta' and M2.manufacturer > 'Minolta';

(c) select D.Manufacturer
    from DigiCams D, Reviews R
    where D.Manufacturer = R.Manufacturer and R.Rating >= 8 and
      D.MaxAp <= 2;

3. (3 \times 3 \text{ pts}) Exhibit the results of evaluating each of the following relational algebra expressions on the above database instance. Note the abbreviations described earlier.
Bag operators are identified using the superscript $B$; the rest are set operators.

(a) $\pi_{SD} \sigma_{R \geq 8} R$

(b) $\pi^B_S C - B \pi_S C$ (The second projection is a set operator.)

(c) $\pi_M((\pi_M \sigma_{P \geq 3.5} \pi_{MP} D \cup \pi_M \sigma_{A \geq 2.5} D) \times \pi_M D)$.

4. (3 x 3 pts) Write SQL queries as directed.

(a) For each camera (manufacturer and model), list its MPix value along with the ratings it received from each source that reviewed it. Ignore cameras with no reviews. The result consists of tuples of the form $(m, l, p, s, r)$, indicating that model $l$ from manufacturer $m$ has MPix $p$ and received a rating of $r$ from source
(b) For each camera (manufacturer and model), list the lowest price in the Catalog. Ignore cameras with no price information. Sort the result in ascending order of manufacturers and (among cameras of a manufacturer) descending order of models. The desired result consists of tuples of the form \((m, l, p)\), where \(p\) is the lowest price for model \(l\) from manufacturer \(m\).

(c) For each review source, list the cameras (manufacturers and models) that received the highest ratings, along with the \texttt{MaxAp} values for those cameras. The desired result consists of tuples of the form \((s, m, l, a)\), indicating that camera model \(l\) from manufacturer \(m\) has maximum aperture value \(a\) and is (one of) the highest rated cameras according to source \(s\). Hint: subquery.

5. (3 \times 3 pts) Write relational algebra queries as directed, using only the operators \(\sigma\), \(\Pi\), \(\times\), \(\rho\), \(\cup\), and \(-\).
(a) List the ratings for Olympus 4040. (The result is a unary relation.)

(b) List cameras (manufacturers and models) in DigiCams that have no reviews.

(c) A query equivalent to the query in Question 4a.