Question 1: Query Execution (Part I) . . . . [210 points]

(i) **[10 points] Processing Models:**
Distinguish between these processing models: iterator, materialization, and vectorized models.

(ii) **[10 points] Processing Models:**
Explain the purpose of the `next` function in an operator.

(iii) **[20 points] Processing Models:**
Write the pseudo-code for processing this query using iterator model.

```
SELECT R.id, S.cdate
        FROM R JOIN S
        ON R.id = S.id
        WHERE S.value > 100
```

(iv) **[10 points] Processing Models:**
Justify the term "pipeline breaker".

(v) **[20 points] Processing Models:**
Write the pseudo-code for processing this query using materialization model.

```
SELECT R.id, S.cdate
        FROM R JOIN S
        ON R.id = S.id
        WHERE S.value > 100
```

(vi) **[10 points] Processing Models:**
Is materialization model a good fit for: (1) OLTP workloads, (2) OLAP workloads?

(vii) **[10 points] Processing Models:**
List two benefits of vectorization model.

(viii) **[20 points] Processing Models:**
Write the pseudo-code for processing this query using vectorization model.

```
SELECT R.id, S.cdate
        FROM R JOIN S
        ON R.id = S.id
        WHERE S.value > 100
```

(ix) **[10 points] Processing Models:**
Explain why SIMD instructions are a good fit for vectorization model.

(x) **[10 points] Processing Models:**
Distinguish between two plan processing directions.

(xi) **[10 points] Access Methods:**
Define a cursor.

(xii) **[10 points] Access Methods:**
Define a bitmap scan. Illustrate with an example.

(xiii) **[10 points] Access Methods:**
Illustrate the utility of zone maps with an example.

Question 1 continues...

(xiv) **[10 points] Access Methods:**
Define tuple stitching. How is connected to late materialization?

(xv) **[10 points] Access Methods:**
List the order in which predicates are evaluated in a query.

(xvi) **[10 points] Access Methods:**
Explain the index scan page sorting optimization.

(xvii) **[10 points] Expression Evaluation:**
Why is WHERE clause stored with a tree representation?

(xviii) **[10 points] Expression Evaluation:**
Distinguish between interpretation and compilation of expressions.