**44-560 Adv Topics in DB Systems**

**Query Optimization KEY**

1. Assume we have the database shown below.



Consider the following query.

**select courseTitle, secNum, course.courseNum, enrolled**

**from section, course**

**where section.courseNum = course.courseNum**

**and course.courseNum < 100;**

There are 600 courses and 1,000 sections being offered this term. There are 25 courses being offered, with 50 sections, that have a course number less than 100. There are three access plans for executing this query on the answer sheet. For the third access plan, assume an index named **courseNum\_NDX** has been created on **courseNum** in the **course** table. Fill in the missing information in the last four columns.

NOTE:

* When using an index, there are two steps – first access the index and then use the index to find the row in the table. In the third access plan, these steps are listed as step C1 and C2. The number of I/O operations will be the same for both steps since you use each index to find the corresponding row in the table. In this example (in the third access plan) you will use the index to find courses with course numbers less than 100. There are 25 such courses. Since the index is sorted, once you find the first index (whose cost we do not count), the remaining ones will follow immediately. So there will be one I/O operation each in step C1 for each of the 25 courses.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Plan** | **Step** | **Operation** | **I/O Operations** | **I/O Cost** | **Resulting Rows** | **Total I/O Cost** |
| **A** | **A1** | **Cartesian product (section, course)** | **600 + 1,000** | **1,600** | **600,000** | **1,600** |
|  | **A2** | **Select rows from A1 with matching course numbers** | **600,000** | **600,000** | **1,000** | **601,600** |
|  | **A3** | **Select rows from A2 with courseNum < 100;** | **1,000** | **1,000** | **50** | **602,600** |
| **B** | **B1** | **Select rows from course with courseNum < 100** | **600** | **600** | **25** | **600** |
|  | **B2** | **Cartesian product (B1, section)** | **25 + 1,000** | **1,025** | **25,000** | **1,625** |
|  | **B3** | **Select rows from B2 with matching course numbers** | **25,000** | **25,000** | **50** | **26,625** |
| **C** | **C1** | **Scan courseNum\_NDX to find course numbers < 100** | **25** | **25** | **25** | **25** |
|  | **C2** | **Use indexes from C1 to find corresponding rows in course table** | **25** | **25** | **25** | **50** |
|  | **C3** | **Cartesian product (C2, section)** | **25 + 1,000** | **1,025** | **25,000** | **1,075** |
|  | **C4** | **Select rows from C3 with matching course numbers** | **25,000** | **25,000** | **50** | **26,075** |