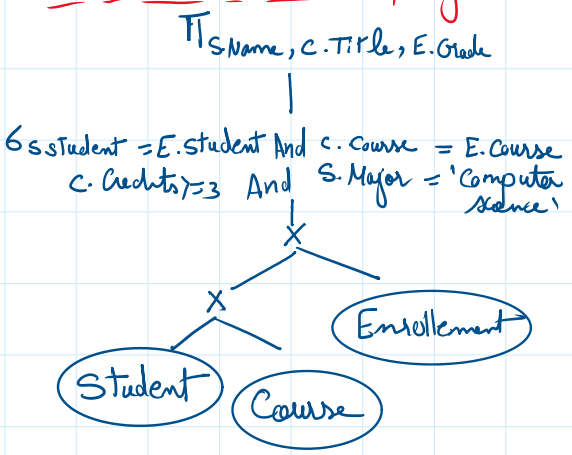
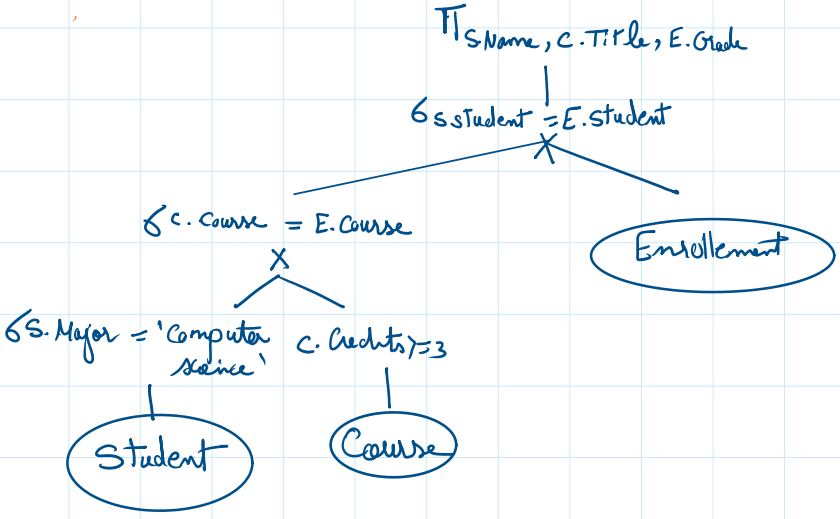
Assignment 1

Thursday, April 24, 2025 7:46 PM

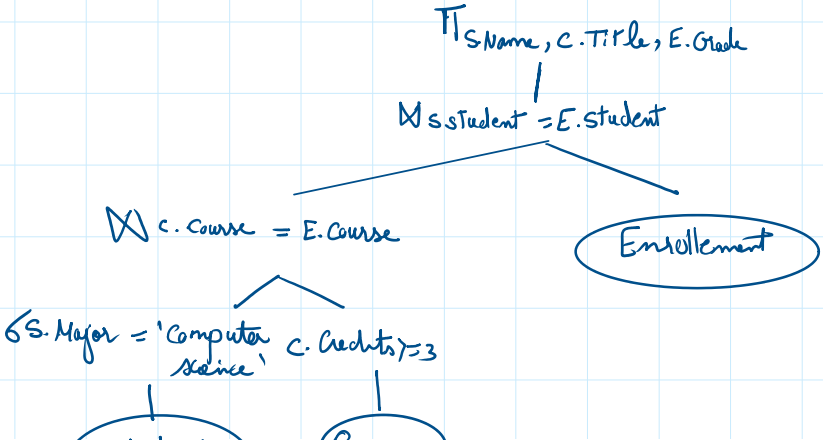
```
SELECT S.Name, C.Title, E.Grade
FROM STUDENT S, COURSE C, ENROLLMENT E
WHERE S.StudentID = E.StudentID
  AND C.CourseID = E.CourseID
  AND S.Major = 'Computer Science'
  AND C.Credits >= 3;
```

Initial Relational Algebra

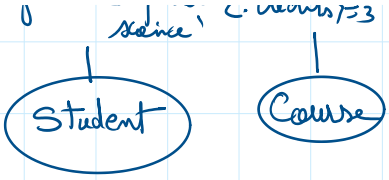


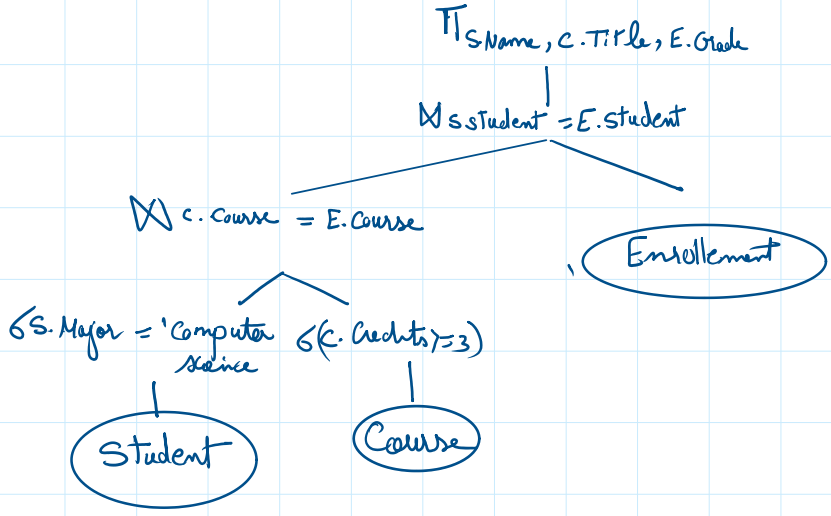


- Push selection down
- Apply $\sigma_{Major='CS'}$ to student early
- Apply $\sigma_{Credit>=3}$ to Course early

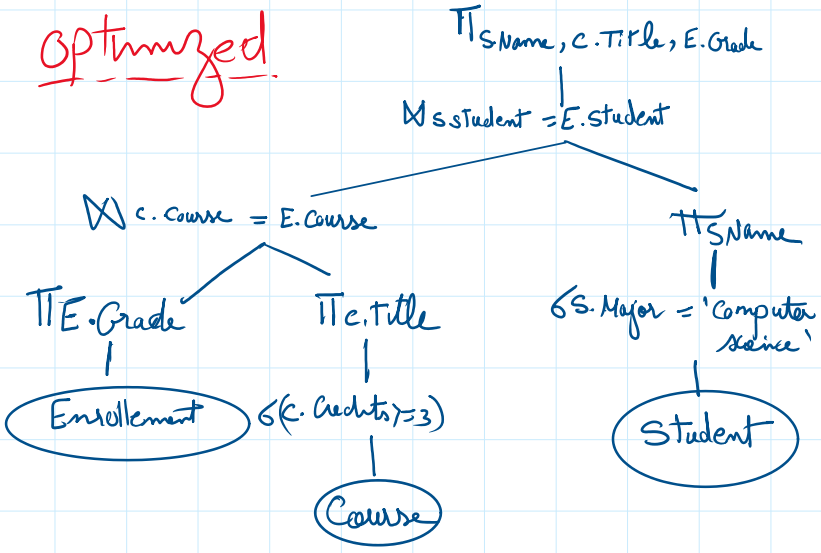


- Replace Cartesian product ($\times$) followed by selection with $\bowtie$ join
- Apply projection (Π) early to reduce tuple size





optimized



CSStudents ← $\sigma_{major = \text{'Computer Science'}}$ (Students)

$Credits \leftarrow \sigma_{Credits>=3}(Course)$

$CSEnroll \leftarrow Credits \bowtie_{c.CourseID = E.CourseID} Enrollment$

$join \leftarrow CSEnroll \bowtie_{S.StudentID = E.StudentID} CSStudents$

$Result \leftarrow \Pi_{name, title, Grade}(join)$

$CSStudents \leftarrow \sigma_{major = 'Computer Science'}(Students)$

$Credits \leftarrow \sigma_{Credits>=3}(Course)$

$CSStudents2 \leftarrow \Pi_{Sname}(CSStudents)$

$Credits2 \leftarrow \Pi_{C.title}(Course)$

$Enroll2 \leftarrow \Pi_{E.grade}(Enrollment)$

$CSEnroll \leftarrow Credits2 \bowtie_{c.CourseID = E.CourseID} Enroll2$

$join \leftarrow CSEnroll \bowtie_{S.StudentID = E.StudentID} CSStudents2$

$Result \leftarrow \Pi_{name, title, Grade}(join)$