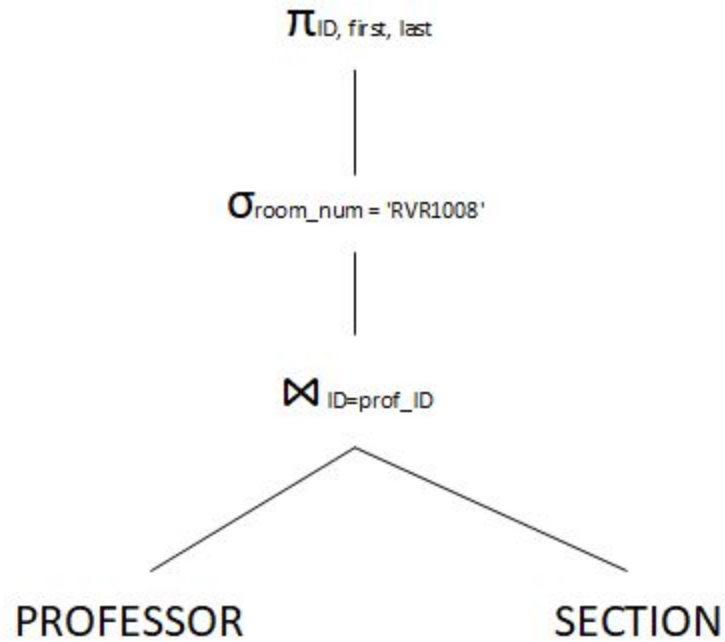


1a)  $\pi_{ID, first, last}(\sigma_{room\_num = 'RVR1008'}(PROFESSOR \bowtie_{ID=prof\_ID} SECTION))$

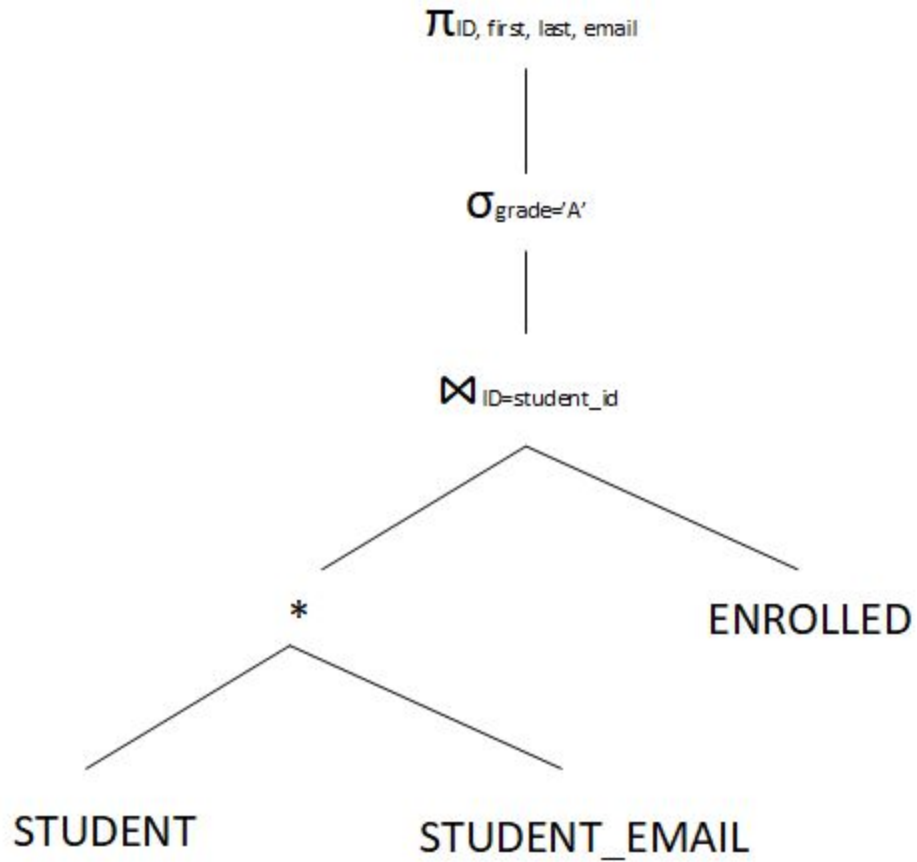
1b)



1c) There is a primary index on PROFESSOR ID.

1d) There is no secondary index.

2a)  $\pi_{ID, first, last, email}(\sigma_{grade='A'}(STUDENT * STUDENT\_EMAIL \bowtie_{ID=student\_id} ENROLLED))$   
 2b)

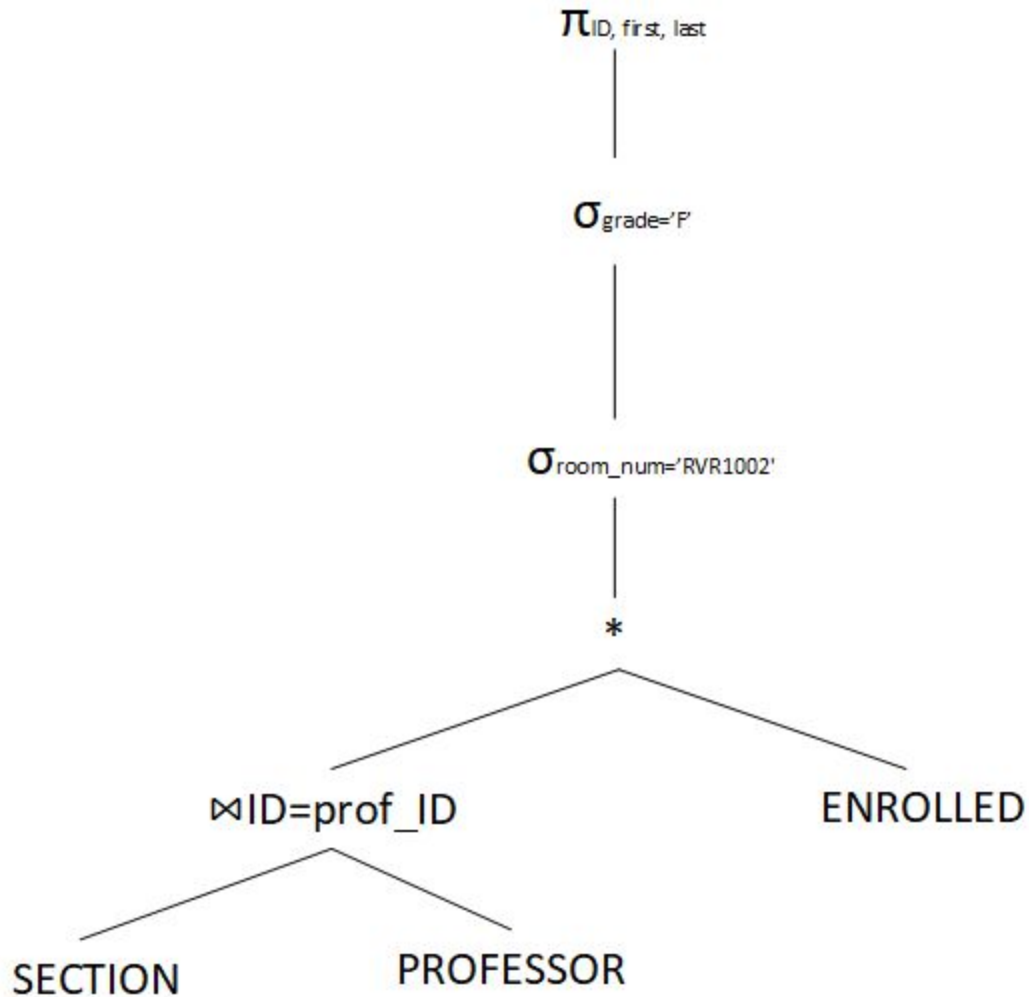


2c) There is a primary index on STUDENT ID.

2d) There is a secondary index on ENROLLED student\_id.

3a)  $\pi_{ID, first, last}(\sigma_{grade='F' \text{ AND } room\_num='RVR1002'}(PROFESSOR \bowtie_{ID=prof\_ID} SECTION$   
 $* ENROLLED)$

3b)

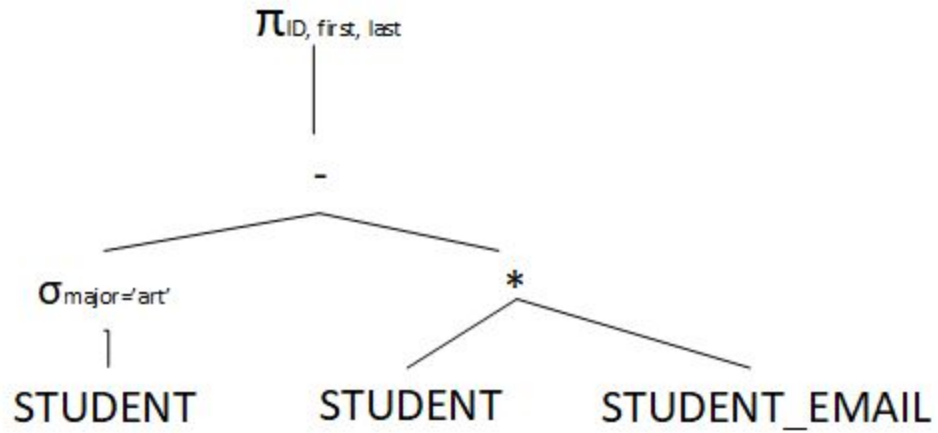


3c) There is a primary index on PROFESSOR ID

3d) There is no secondary index.

4a)  $(\pi_{ID, first, last}(\sigma_{major='art'}(STUDENT))) - (\pi_{ID, first, last}(STUDENT * STUDENT\_EMAIL))$

4b)



4c) There is a primary index on STUDENT major. There is a primary index on STUDENT ID

4d) There is no secondary index.