

2. (a)

- i. $\Pi_{eid}(\sigma_{aname='boeing'}(Aircraft) \bowtie Certified))$
- ii. $\Pi_{ename}(\sigma_{aname='boeing'}(Aircraft) \bowtie Certified \bowtie Employees)$
- iii. $\Pi_{aid}(Aircraft \bowtie_{cruisingrange \geq distance} (\sigma_{from='Bonn' \text{ AND } to='Madras'}(Flights)))$
- iv. $\Pi_{flno} (\sigma_{salary > 100000 \text{ AND } distance < cruisingrange} Employees \bowtie Certified \bowtie Aircraft \bowtie Flights)$
- v. $R1 = \Pi_{ename}(Employees \bowtie Certified \bowtie \sigma_{cruisingrange > 3000}(Aircraft))$
 $R2 = \Pi_{ename}(Employees \bowtie Certified \bowtie \sigma_{name='boeing'}(Aircraft))$
 $R3 = R1 - R2$
- vi. $R1 = \rho_{E1}(Employees)$
 $R2 = \rho_{E2}(Employees)$
 $R3 = \Pi_{E2.eid} (E1 \bowtie_{E1.salary > E2.salary} E2)$
 $R4 = \Pi_{eid} E1$
 $R5 = R4 - R3$
- vii. $R1 = Employees$
 $R2 = \rho_{R2(eid2, ename2, salary2)}(Employees)$
 $R3 = (R1 \bowtie_{salary < salary2} R2)$
 $R4 = R1 - R3$
 $R5 = R1 - R4$
 $R6 = \rho_{R6(eid6, ename6, salary6)}(R5)$
 $R7 = \Pi_{eid, ename, salary} (R5 \bowtie_{salary < salary6} R6)$
 $R8 = \Pi_{eids} (R5 - R7)$
- viii. No relational algebra because there is no way to use count in RA.
- ix. $R1 = \Pi_{eid, aid}((Employees \bowtie Certified) \bowtie Aircraft)$
 $R2 = \rho_{R2(eid2, aid2)}(R1)$
 $R3 = \rho_{R3(eid3, aid3)}(R1)$
 $R4 = \rho_{R3(eid4, aid4)}(R1)$
 $R5 = R1 \bowtie_{aid \neq aid2 \text{ AND } eid=eid2} R2$
 $R6 = R5 \bowtie_{aid \neq aid2 \text{ AND } aid2 \neq aid3 \text{ AND } eid=eid3} R3$
 $R7 = R6 \bowtie_{aid \neq aid2 \text{ AND } aid2 \neq aid3 \text{ AND } aid3 \neq aid4 \text{ AND } eid=eid4} R4$
 $R8 = \Pi_{eid}(R6 - R7)$
- x. No relational algebra because there is no way to use sum in RA