Question 2

i) $\Pi_{eid}(\sigma_{aname="Boeing"}(Aircraft \bowtie Certified))$

ii) $\Pi_{ename}((\sigma_{aname="Boeing"}(Aircraft)) \bowtie Certified \bowtie Employees)$

iii) $R1 = \sigma_{from="Bonn" \wedge to="Madras"}(Flights)$
$\Pi_{aid}(\sigma_{cruisingrange > distance}(Aircraft \times R1))$

iv) $\Pi_{flno}(\sigma_{distance < cruisingrange \wedge salary > 100000}(Flights \bowtie Aircraft \bowtie Certified \bowtie Employees))$

v) $R1 = \Pi_{eid}(\sigma_{cruisingrange > 3000}(Aircraft \bowtie Certified))$
$\Pi_{ename}(Employees \bowtie (R1 - \Pi_{eid}(\sigma_{aname="Boeing"}(Aircraft \bowtie Certified))))$

vi) $P_{E1}(Employees)$
$P_{E2}(Employees)$
$\Pi_{eid}(Employees) - \Pi_{E1.eid}(E1 \bowtie_{E1.salary < E2.salary} E2)$

vii) $E1 = P_{E1}\,Employees$
$E2 = P_{E2}\,Employees$
$E3 = \Pi_{E2.eid}(E1 \bowtie_{E1.salary > E2.salary} E2)$
$E4 = E2 \bowtie E3$
$E5 = P_{E5}\,E4$
$E6 = \Pi_{E5.eid}(E4 \bowtie_{E1.salary > E5.salary} E5)$
$(\Pi_{eid}\,E3) - E6$

viii) Cannot be shown in relational algebra because we don't have a symbol for counting.

ix) $R1 = P_{R1}\,Certified$, $R2 = P_{R2}\,Certified$, $R3 = P_{R3}\,Certified$, $R4 = P_{R4}\,Certified$
$R5 = \Pi_{eid}(\sigma_{(R1.eid = R2.eid = R3.eid) \wedge (R1.aid \neq R2.aid)}(R1 \times R2 \times R3))$
$R6 = \Pi_{eid}(\sigma_{(R1.eid = R2.eid = R3.eid = R4.eid) \wedge (R1.aid \neq R2.aid \neq R3.aid \neq R4.aid)}(R1 \times R2 \times R3 \times R4))$
$R5 - R6$

x) Not possible in relational algebra because there isn't a symbol for sum.