

For all the questions, consider the database schema given below:

- Location(country, cnumber)
- Airport(city, ano, cnumber, year)
- Works(worker, ano)

**NOTE:**  $\star$  is equivalent to  $\bowtie$

1. (2.5) For the sample database instance, give the output of the following query:

$$\pi_{country} Location - \pi_{country}(Location \star Airport)$$

2. (2.5) For the sample database instance, give the output of the following query:

$$\pi_{worker}(Works \star \sigma_{city='Church'} Airport \star \sigma_{country='UK'} Location)$$

3. (2.5) What does the following expression compute?

$$\pi_{worker} Works - \pi_{worker}(Airport \star \sigma_{country='NZ'} Location \star Works)$$

- (a) Workers who work in at least one airport outside NZ
- (b) Workers who work in at least one airport in NZ
- (c) Workers who only work in NZ
- (d) Workers who do not work in NZ

4. (2.5) Which of the following expressions computes the query: *The first year that an airport was constructed?*

- (a)  $\pi_{year} Airport - \pi_{year} \sigma_{year > y_2}(Airport \times \rho_{Airport(ct, a_2, c_2, y_2)} Airport)$
- (b)  $\pi_{year} Airport - \pi_{year} \sigma_{year < y_2}(Airport \times \rho_{Airport(ct, a_2, c_2, y_2)} Airport)$
- (c)  $\pi_{year} \sigma_{year > y_2}(Airport \times \rho_{Airport(ct, a_2, c_2, y_2)} Airport)$
- (d)  $\pi_{year} \sigma_{year < y_2}(Airport \times \rho_{Airport(ct, a_2, c_2, y_2)} Airport)$