

### 1. Relational Languages: Relational Algebra, Datalog & SQL

Consider the following schema:

Coffee(cbrand, producer)

CoffeeShop(sname, addr)

Sells(sname, cbrand, price)

Attributes *cbrand* and *producer* in relation *Coffee* are names and producers of coffee brands, respectively. Attributes *sname* and *addr* in relation *CoffeeShop* contain the names and addresses of coffee shops. The relation *Sells* stores the price at which coffee shops sell different brands of coffee. The underlined attributes are the keys for their relations.

- (a) (3 points) Write a relational algebra (RA) query that returns the address of every coffee shop that sells the brand 'Coava'. 'Coava' is a brand of coffee.

- (b) (3 points) Write a Datalog query that returns the address of every coffee shop that sells **only** the brand 'Coava'. 'Coava' is a brand of coffee.

(c) (2 points) Write a SQL query that returns each producer that makes the most expensive brand(s) of coffee, i.e., coffee brand(s) sold at the highest price.

(d) (2 points) Write a SQL query that returns the address of each coffee shop that sells every brand in the *Coffee* relation.

(e) (3 points) Write a SQL query that returns the addresses of every pair of coffee shops that sell the same set of coffee brands.

(f) (2 points) Write a SQL query that returns the address of every coffee shop that sells **only** the brand 'Coava'. 'Coava' is a brand of coffee.