ONID:

CS540 Database Management Systems

Winter 2021

School of Electrical Engineering & Computer Science

Oregon State University

Midterm Examination

Time Limit: 80 minutes

- The exam is open book and notes.
- Any form of cheating on the examination will result in a zero grade.
- Please make your answers clear and succinct; you will lose credit for verbose, convoluted, or confusing answers. *Simplicity does count!*

Question:	1	2	3	Total
Points:	10	5	2	17
Score:				

1. **Relational Languages: SQL & Datalog**
   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) (1 point) 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.

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

(c) (2 points) Write a SQL query that returns the addresses of every pair of coffee shops that sell the same set of coffee brands.

(d) (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.

(e) (1 point) Consider the following SQL query.

```
SELECT C.cbrand
FROM Coffee C, Sells S
WHERE C.cbrand = S.cbrand
Group By C.cbrand
Having count(producer) > 10
```

Rewrite the above query without using the Group By and Having clauses so that the resulting query still produces the same result.

(f) (2 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.

2. **Schema Normalization: BCNF & 3NF**
   Consider relation $R(A, B, C, D)$ with functional dependencies $A \rightarrow B$ and $C \rightarrow D$.

   (a) (3 points) Is relation R in BCNF? If it is not, convert it to a schema that is in BCNF.

   (b) (2 points) Is relation R in 3NF? If it is not, convert it to a schema that is in 3NF.

3. **Schema Normalization: Lossless Decomposition & Dependency Preservation** Consider relation $R(A, B, C, D, E, F)$ with the following functional dependencies: $A \rightarrow CDF$, $D \rightarrow A$ and $DF \rightarrow E$. We decompose R into two relations, $S(A, B, C, D)$ and $T(D, E, F)$.

   (a) (1 point) Is this decomposition a lossless decomposition? Briefly justify your answer.

   (b) (1 point) Is this decomposition a dependency-preserving decomposition? Briefly justify your answer.