Instructions: Turn in your answers to the questions below in class on or before the due date. You must include each question below as part of your answer (inlcuding the question number). Be sure your answers are legible. Note that each question is worth 1 point (for a total of 10 points).

1. Give the cardinality and arity of each of the following relations.

customer

cust_num	*cust_name*	*location*
103	Bob	Spokane, WA
101	Alice	Seattle, WA
104	Charlie	Portland, OR
102	Alice	Seattle, WA

Cardinality: 4
arity: 3

order

order_num	*order_date*	*cust_id*	*order_amt*
1000	10-02	103	53
1001	10-02	101	47
1002	10-03	103	53

Cardinality: 3
Arity: 4

2. Assume the following schema (where Customer and Order are the same as in Question 1) such that an order can be made up of multiple items, each item can be in multiple orders, and each item is identified by a unique item number.

- customer(cust_num, cust_name, location) cust_num
- order(order_num, order_date, cust_id, order_amt) order_num
- order_item(order_num, item_num, quantity) order_num, item num
- item(item_num, item_weight, unit_price) item_num

Give the most appropriate primary key for each of the four relations.

3. Using the schema in Question 2, identify the corresponding foreign keys.

order_item.order_num REFS order.order_num
order_item.item num REFS item.item num

4. Consider the following schema for representing library branches and their (book) holdings, such that the primary keys are underlined and `holding.brance_location` is a foreign key to the `branch` relation.

- `branch(branch_id, branch_name, library_name)`
- `holding(serial_no, isbn, condition, branch_location)`

Assume you have been asked to add the following information to the relations (both of which are currently empty).

- A holding with serial number 1122, isbn 0914894366, in good condition, at branch 1.
- A holding with serial number 1123, isbn 1558604561, in fair condition, at branch 2.
- A holding with serial number 1124, isbn 0521150116, in excellent condition, at branch 2.
- A holding with serial number 1125, isbn 0131964283, in good condition, at branch 3.
- A Central branch of the Spokane Public Library system with a branch id of 1.
- A Hillyard branch of the Spokane Public Library system with a branch id of 2.

(a) Give the corresponding rows for the information above, (b) an insertion ordering for the rows that avoids violating integrity constraints, and (c) the information that cannot be inserted (because of integrity constraint violations).

5. Consider the following relation for representing part and supplier distribution channels such that couriers (i.e., delivery services) can deliver parts from suppliers to stores.

```
distribution(courier, supplier, store)
```

For each scenario below give a corresponding primary key for the `distribution` table.

(a). A courier can only supply parts to a single store. However, stores can have multiple couriers that it uses.

(b). A store only has a single courier. However, couriers and suppliers can transport and supply to many different stores.

(c). Stores can only use one courier per supplier. However, stores can use many different suppliers for parts.

6. Consider the following relation for representing checks issued against bank accounts, where a specific check is represented by a check number relative to an account number.

```
check_debit(acct_num, check_num, amount, date)
```

Assume instead of using a composite key, the DBA decided to add a surrogate key called `check_id` to the `check_debit` relation. (a) Give the new relation (with the primary key underlined); (b) give an instance of the new `check_debit` relation that violates the key constraints in the original version; and (c) describe the constraint violation and its potential impact.

7. Design a relational schema to represent the following information. Give (a) the schema including primary and foreign keys; (b) the corresponding schema diagram; and (c) example instances for each relation (with *at least* three rows per relation).

- Car information that includes VINs (vehicle identification numbers), makes (e.g., "Toyota"), models (e.g., "Supra"), years, and MSRPs (manufacturer suggested retail prices).
- Car accessory selections for specific VINs that include the name of the accessory (e.g., "floor mats"), the accessory product id, and the accessory's added price. Each specific car (i.e., VIN) can have zero or more accessory selections (with different product ids), but only at most one selection of a specific product id.

8. Design a relational schema to represent the following information. Give (a) the schema including primary and foreign keys; (b) the corresponding schema diagram; and (c) example instances for each relation (with *at least* three rows per relation).

- Student information that includes first and last names, majors (e.g., "BSCS"), and student ids. Assume each student has one major as well as a unique student id.
- Course information that includes course names, home departments (e.g., "CPSC"), and course numbers (e.g., "321"). Assume each course has a single name and home department, and that course numbers are unique within each home department.
- Student enrollment information that captures the courses students are enrolled in each semester. Assume semesters are either "Fall" or "Spring". A specific semester is identified by the semester and year (separately). A student can be enrolled in many courses each semester, but cannot be enrolled in the same course multiple times in the same semester. Each student enrollment also includes the grade the student received in the course ("A", "A-", "B+", etc.).

9. Design a relational schema to represent the following information. Give (a) the schema including primary and foreign keys; (b) the corresponding schema diagram; and (c) example instances for each relation (with *at least* three rows per relation).

- Employee information that includes first and last names, office numbers, employment start year, and employee ids. Assume each employee has a unique employee id.

- Management information that represents employees that manage (are managed by) other employees. Each employee can be managed by at most one employee and an employee can manage zero or more other employees.

10. Pick a web or Android/iOS app that you frequently use. In plain English, describe the type of information you think it is storing in terms of potential underlying relations used. Note that you don't need to specify the details of the relations, just explain how the information might be broken out into relations (generally).