Name: _____

Please answer the following questions within the space provided on the following pages. Should you need more space, you can use scratch paper, but clearly label on the scratch paper what problem it corresponds to. While you are not required to explain your queries, comments may help me to understand what you were trying to do and thus increase the likelihood of partial credit should something go wrong. If you get entirely stuck somewhere, explain in words as much as possible what you would try.

This is a pen and paper exam, and thus computers and internet capable devices are prohibited. If you have any confusion about question intention or wording, please do not hesitate to ask!

Your work must be your own on this exam, and under no conditions should you discuss the exam or ask questions to anyone but myself. Failure to abide by these rules will be considered a breach of Willamette's Honor Code and will result in penalties as set forth by Willamette's academic honesty policy.

Please sign and date the below lines to indicate that you have read and understand these instructions and agree to abide by them. *Failure to abide by the rules will result in a 0 on the test.* Good luck!!

_____ _____

Signature Date

Question:	1	2	3	4	5	Total
Points:	3	8	6	15	18	50
Score:						

1. Consider a table created with the following query, which has then been populated to have 5 million rows.

```
CREATE TABLE to_index_or_not (
  id SERIAL PRIMARY KEY,
  name TEXT,
  birthday DATE,
  favorite_num INT
);
```

The question you are faced with is whether it would be worthwhile to add an index to the birthday column, via:

```
CREATE INDEX bdindex ON to_index_or_not (birthday);
```

For each of the below queries, run today, indicate whether the index would be useful for speeding up *that particular query.*

(1) (a)
```
SELECT name
FROM to_index_or_not
WHERE birthday = 'Jan 5, 2014'
```

A. Index useful
B. Index not useful

(1) (b)
```
SELECT name, birthday
FROM to_index_or_not
WHERE favorite_num = 8
```

A. Index useful
B. Index not useful

(1) (c)
```
SELECT MIN(name)
FROM to_index_or_not
WHERE birthday < 'October 29, 2024'
```

A. Index useful
B. Index not useful

2. On the last page of this exam are three tables that you will utilize for both problems 2 and 4. I put them on the last page so that you could rip it off to use as an easier reference. Looking at tables `tab1`, `tab2` and `tab3`, for each of the following queries, determine whether that query would run successfully or not. If it does not, explain directly what error would occur and why it occurred.

(2) (a)
```
INSERT INTO tab3 VALUES
(7, -4, 'Katy', '2022-02-14');
```

(2) (b)
```
UPDATE tab2
SET E = -4.83;
```

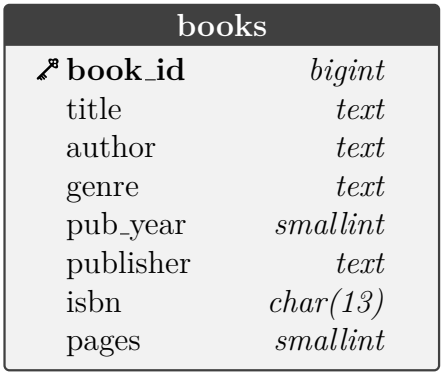
(2) (c)
```
ALTER TABLE tab3 ALTER COLUMN G SET DATA TYPE INT;
```

(2) (d)
```
DELETE FROM tab1
WHERE A = 'Henry' AND B = 0;
```

(3) 3. (a) What normal form is the below table currently in? Justify your answer for full points.

🔑 course_id	course_name	course_type	cert_req
201	Safety Protocols	Safety	Yes
202	Advanced Welding	Technical	Yes
203	Customer Relations	Soft Skills	No
204	Machine Maintenance	Technical	Yes
205	Leadership Basics	Soft Skills	No
206	Conflict Resolution	Soft Skills	No
207	Electrical Safety	Safety	Yes
208	Chemical Handling	Safety	Yes
209	Basic Programming	Technical	Yes
210	Communication Strategies	Soft Skills	No

(3) (b) Below are the ERD summary of a table and the unnormalized data that should be inserted into it. What normal form is this table in? Justify your answer for full points.




```
[
  {
        "BookID": 1,
        "Title": "The Little Prince",
        "Author": "Antoine de Saint-Exupery",
        "Genre": "Children's",
        "PublicationYear": 1943,
        "Publisher": "Reynal & Hitchcock",
        "ISBN": "9780156012195",
        "PageCount": 96
  },
  {
        "BookID": 2,
        "Title": "To Kill a Mockingbird",
        "Author": "Harper Lee",
        "Genre": "Young Adult",
        "PublicationYear": 1960,
        "Publisher": "J.B. Lippincott & Co.",
        "ISBN": "9780061120084",
        "PageCount": 281
  },
  {
        "BookID": 3,
        "Title": "1984",
        "Author": "George Orwell",
        "Genre": "Dystopian Fiction",
        "PublicationYear": 1949,
        "Publisher": "Secker & Warburg",
        "ISBN": "9780451524935",
        "PageCount": 328
  }
]
```

4. Here, we will reuse the same tables as from Problem 2 (assuming none of the alterations from Problem 2 were done) located on the last page of this test. Use these tables to compute the output of the following queries. Output should include column names, as well as content.

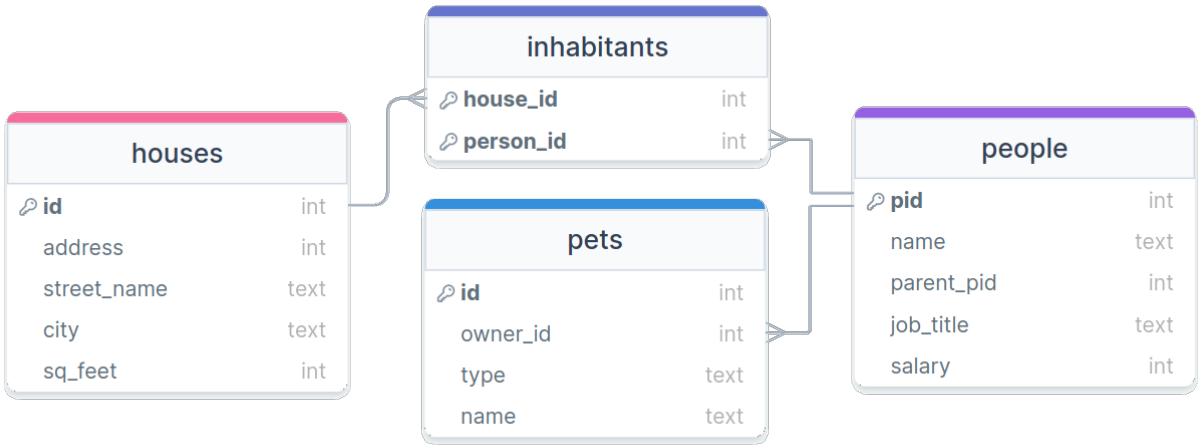
(5) (a)
```
SELECT tab2.D, AVG(tab3.F) AS avg_f
FROM tab3
RIGHT JOIN tab2
   ON tab2.D = tab3.I
GROUP BY tab2.D
ORDER BY tab2.D;
```

(5) (b)
```
SELECT COUNT(*) - MAX(tab1.B + tab3.F) AS value
FROM tab1
FULL OUTER JOIN tab3
  ON tab1.B = tab3.F;
```

(5) (c)

```sql
SELECT AVG(tab1.B) + COUNT(tab2.D) AS num
FROM tab1
LEFT JOIN tab2
  ON tab1.C = tab2.E
JOIN tab1 AS ttab1
  ON ttab1.B > tab1.C;
```

5. You have gathered together some census data on people living in a variety of different housing situations, resulting in the collect of the 4 tables shown below. This ERD is also included on the back of the last page, for easier reference while working on these problems.



Given this collection of tables, where primary and foreign keys have been defined as shown, write out a query that would answer each of the following questions. All of these questions *can* be answered with a single query (and no subqueries), but feel free to use multiple queries if you want. Just make sure it is clear to me what you are doing.

(6) (a) How many houses have nobody living within them?

(6) (b) What are the names of the `'CEO'`'s who own more than 3 pets?

(6) (c) How many different households have a parent living with a child?

Tables for problems 2 and 4:

tab1

```
CREATE TABLE tab1 (
  A TEXT,
  B INT CHECK (B >= 0),
  C NUMERIC(4,2) UNIQUE,
  PRIMARY KEY (A, B)
);
```

A	B	C
Henry	2	4.23
Jake	1	10.52
Henry	0	5.17
Katy	3	-4.83
Jake	4	83.10

tab2

```
CREATE TABLE tab2 (
  D DATE PRIMARY KEY,
  E NUMERIC(4,2)
    REFERENCES tab1 (C)
);
```

D	E
2022-02-14	10.52
2022-01-30	83.10
2022-04-24	4.23

tab3

```
CREATE TABLE tab3 (
  F INT PRIMARY KEY,
  G REAL,
  H TEXT,
  I DATE
    REFERENCES tab2 (D)
  CHECK (F > G)
);
```

F	G	H	I
2	1.1	Jake	2022-01-30
8	6.445	Katy	2022-04-24
0	-0.24	Henry	2022-01-30

ERD from Problem 5, repeated for ease of access: