Part 1:
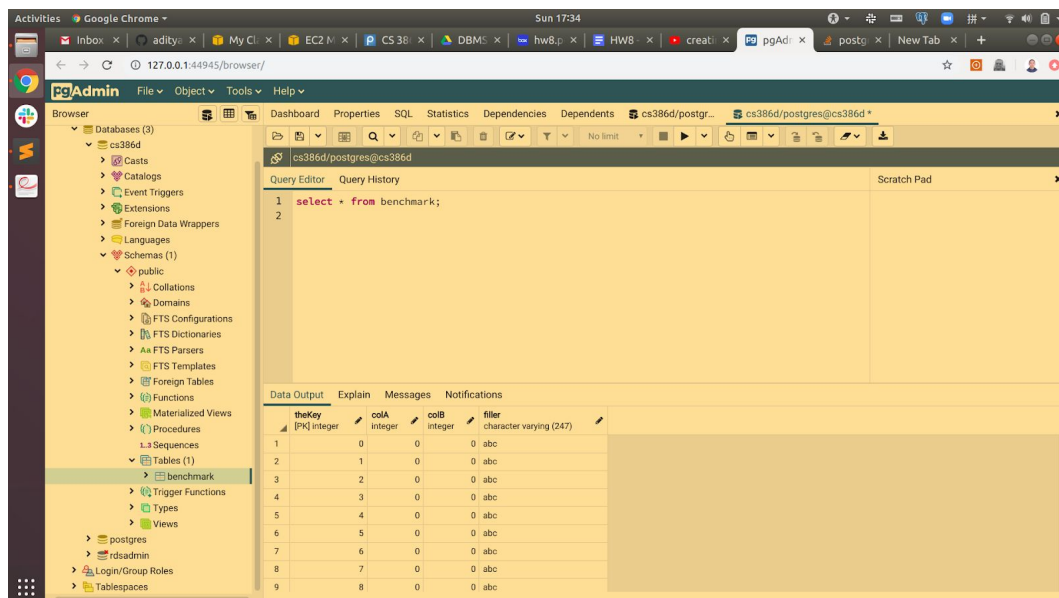
To be clear, the size of a 5-million-row table at 128 bytes each should be 5,000,000 * 128 / 2^30 = 0.60GB.

The time to load such a relation took about 7 minutes (unsorted), which is 7 * 60 = 420 seconds. Hence, the I/O bandwidth should be 1.25 * 2^10 MB / 420 s = 3 MB/s

Extra credit: I don't remember what exactly your second calculation is, but I think you divided the (mistaken) relation size by minutes, rather than seconds.

Part 2:

I have spun-up an instance of Postgres in AWS and connect to it with pgAdmin locally. Below is a screenshot of a simple query:

Part 3:

A. The following screen shot is the query as well as the result:

```
21  select *
22  from utemployee as R
23  where R.appointment = 'Professor' and
24        R.supervisorname in
25          (select T.name from utemployee as T where T.name = R.supervisorname
26          and T.supervisorname in
27          (select K.name from utemployee as K where K.name = T.supervisorname
28          and K.college = 'Natural Sciences'));
```

Data Output  Explain  Messages  Notifications

| name [PK] character varying (50) | appointment character varying (50) | college character varying (50) | department character varying (50) | supervisorname character varying (50) |
|---|---|---|---|---|
| 1 | Miranker | Professor | [null] | Computer Science | Fussell |
| 2 | Mok | Professor | [null] | Computer Science | Fussell |
| 3 | Alcook | Professor | [null] | Mathematics | Beckner |

B.
- The DDL is listed as follows:

```
1  create table utemployee2 (
2      name character varying(50) primary key,
3      appointment character varying(50),
4      college character varying(50),
5      department character varying(50),
6      supervisorname character varying(50) references utemployee2(name) on delete set null
7  );
```

- The table content, after deleting Chairman Fussell, is listed as follows:

```
21  delete from utemployee2
22  where name = 'Fussell';
23
24  select * from utemployee2;
```

Data Output  Explain  Messages  Notifications

| name [PK] character varying (50) | appointment character varying (50) | college character varying (50) | department character varying (50) | supervisorname character varying (50) |
|---|---|---|---|---|
| 1 | Fenves | President | [null] | [null] | [null] |
| 2 | Goldbart | Dean | Natural Sciences | [null] | Fenves |
| 3 | Wood | Dean | Engineering | [null] | Fenves |
| 4 | Beckner | Chairman | [null] | Mathematics | Goldbart |
| 5 | Tewfik | Chairman | [null] | Electrical and Computer Eng… | Wood |
| 6 | Ghosh | Professor | [null] | Electrical and Computer Eng… | Tewfik |
| 7 | Alcook | Professor | [null] | Mathematics | Beckner |
| 8 | Miranker | Professor | [null] | Computer Science | [null] |
| 9 | Mok | Professor | [null] | Computer Science | [null] |

C.
- The DDL is listed as follows:

```
1   create table utemployee3 (
2       name character varying(50) primary key,
3       appointment character varying(50),
4       college character varying(50),
5       department character varying(50),
6       supervisorname character varying(50) references utemployee3(name) on delete cascade
7   );
```

- The table content, after deleting Dean Goldbart, is listed as follows:

```
21  delete from utemployee3
22  where name = 'Goldbart';
23
24  select * from utemployee3;
```

Data Output    Explain    Messages    Notifications

| | name<br>[PK] character varying (50) | appointment<br>character varying (50) | college<br>character varying (50) | department<br>character varying (50) | supervisorname<br>character varying (50) |
|---|---|---|---|---|---|
| 1 | Fenves | President | [null] | [null] | [null] |
| 2 | Wood | Dean | Engineering | [null] | Fenves |
| 3 | Tewfik | Chairman | [null] | Electrical and Computer Eng... | Wood |
| 4 | Ghosh | Professor | [null] | Electrical and Computer Eng... | Tewfik |

D.
There is some ambiguity in this problem: If the chairman of the Computer Science department changes from "Fussell" to "Smith", then that counts as an update so we should update all the professors in the CS department such that their new supervisor name is now "Smith".
But, another way to look at this is that, since we updated the name attribute of the record from "Fussell" to "Smith", then we can no longer find a record with name being "Fussell" in our table, hence that means "Fussell" has lost his job and therefore all the professors in the CS department will lose their job, achieved by deleting those rows.
I will go with the first interpretation for this problem.

- The DDL is listed as follows:

```
1   create table utemployee4(
2       name character varying(50) primary key,
3       appointment character varying(50),
4       college character varying(50),
5       department character varying(50),
6       supervisorname character varying(50) references utemployee4(name) on update cascade
7   );
```

- The table content, after changing Dean of Computer Science department from "Fussell" to "Smith", is listed as follows:

```
21  update utemployee4
22  set name = 'Smith'
23  where name = 'Fussell';
24
25  select * from utemployee4;
```

Data Output  Explain  Messages  Notifications

| name [PK] character varying (50) | appointment character varying (50) | college character varying (50) | department character varying (50) | supervisorname character varying (50) |
|---|---|---|---|---|
| 1 | Fenves | President | [null] | [null] | [null] |
| 2 | Goldbart | Dean | Natural Sciences | [null] | Fenves |
| 3 | Wood | Dean | Engineering | [null] | Fenves |
| 4 | Beckner | Chairman | [null] | Mathematics | Goldbart |
| 5 | Tewfik | Chairman | [null] | Electrical and Computer Eng… | Wood |
| 6 | Ghosh | Professor | [null] | Electrical and Computer Eng… | Tewfik |
| 7 | Alcook | Professor | [null] | Mathematics | Beckner |
| 8 | Smith | Chairman | [null] | Computer Science | Goldbart |
| 9 | Miranker | Professor | [null] | Computer Science | Smith |
| 10 | Mok | Professor | [null] | Computer Science | Smith |