



1. part 2

Not captured in ER

- Score is not limited from 1 to 5 for eval.
- feature constraints not present, we can only have one of $\{4, 5, 6\}$
- $\{1, 2\}$ also have to hold, camera is either one not both.

Q2 part 2:

2.a

```
CREATE TABLE product (  
    pid          INTEGER NOT NULL,  
    model        VARCHAR(20),  
    manufacturer  VARCHAR(20),  
    retail_price  FLOAT,  
    num_in_stock  INTEGER,  
    release_date  DATE,  
    PRIMARY KEY (pid)  
);
```

```
CREATE TABLE camera (  
    pid          INTEGER NOT NULL,  
    pixel_num     FLOAT,  
    sensor_size   FLOAT,  
    fid_primary   INTEGER,  
    fid_secondary INTEGER,  
    FOREIGN KEY (fid_primary) REFERENCES finder_feature(fid),  
    FOREIGN KEY (fid_secondary) REFERENCES finder_feature(fid),  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES product(pid)  
);
```

```
CREATE TABLE finder_feature (  
    fid          INTEGER NOT NULL  
    PRIMARY KEY (fid)  
);
```

```
CREATE TABLE replacable_lens_camera (  
    pid          INTEGER NOT NULL,  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES camera(pid)  
);
```

```
CREATE TABLE lens (  
    pid          INTEGER NOT NULL,  
    aperture_min  FLOAT,  
    aperture_max  FLOAT,  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES product(pid)  
);
```

```
CREATE TABLE built_in_lens_cam (  
    pid            INTEGER NOT NULL,  
    aperture_min   FLOAT,  
    aperture_max   FLOAT,  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES camera(pid)  
);
```

```
CREATE TABLE prime_lens (  
    pid            INTEGER NOT NULL,  
    focal_length   FLOAT,  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES lens(pid)  
);
```

```
CREATE TABLE telescopic_lens (  
    pid            INTEGER NOT NULL,  
    focal_min      FLOAT,  
    focal_max      FLOAT,  
    PRIMARY KEY (pid),  
    FOREIGN KEY (pid) REFERENCES lens(pid)  
);
```

```
CREATE TABLE lens_used (  
    camera_id      INTEGER NOT NULL,  
    lens_id        INTEGER NOT NULL,  
    PRIMARY KEY (camera_id, lens_id),  
    FOREIGN KEY (camera_id) REFERENCES replacable_lens_camera(pid),  
    FOREIGN KEY (lens_id) REFERENCES lens(pid)  
);
```

```
CREATE TABLE customer (  
    cid            INTEGER NOT NULL,  
    name           VARCHAR(20),  
    email          VARCHAR(20),  
    shipping_address VARCHAR(50),  
    PRIMARY KEY (cid)  
);
```

```
CREATE TABLE customer_evaluation (  
  cid          INTEGER NOT NULL,  
  pid          INTEGER NOT NULL,  
  score        INTEGER NOT NULL,  
  comment      VARCHAR(100),  
  PRIMARY KEY (cid, pid),  
  FOREIGN KEY (cid) REFERENCES customer(cid),  
  FOREIGN KEY (pid) REFERENCES product(pid),  
  check (score >= 1 and score <= 5)  
);
```

```
CREATE TABLE foreign_customer (  
  cid          INTEGER NOT NULL,  
  PRIMARY KEY (cid),  
  FOREIGN KEY (cid) REFERENCES customer(cid)  
);
```

```
CREATE TABLE domestic_customer (  
  cid          INTEGER NOT NULL,  
  PRIMARY KEY (cid),  
  FOREIGN KEY (cid) REFERENCES customer(cid)  
);
```

```
CREATE TABLE purchase_order (  
  cid          INTEGER NOT NULL,  
  pid          INTEGER NOT NULL,  
  sell_price   FLOAT,  
  outstanding  BOOLEAN,  
  FOREIGN KEY (cid) REFERENCES customer(cid),  
  FOREIGN KEY (pid) REFERENCES product(pid)  
);
```

2b.

not both.

Q2 part 2:

$$R1 \leftarrow \pi_{\text{productid}}((\text{camera} \bowtie \text{replaceable}) \bowtie (\text{lens} \bowtie \text{prime}))$$

$$R2 \leftarrow \pi_{\text{productid}} \left(\sigma_{x.\text{focallength} = \text{focallength} \wedge x.\text{aperture} < \text{aperture} \wedge x.\text{pid} \neq \text{pid} \wedge x.\text{retailprice} < \text{retailprice}} \right. \\ \left. \pi_{\text{lens} \bowtie \text{prime} \bowtie \text{product}} \cup \rho_{\text{pid, focallength, aperture, retailprice}} (\pi_{\text{pid, focallength, aperture, retailprice}} (\text{lens} \bowtie \text{prime} \bowtie \text{product})) \right)$$

lens or cameras that violate stored in result

$$\text{result} = \pi_{\text{productid}}((\sigma(\text{lens}) - R1) \cup (\sigma(\text{camera}) - R1) \cup R2)$$

3. 1. $[ABC]^+ = ABCD$

$[DBC]^+ = ABCD$

Candidate Keys	PA = ABCD
ABC, DBC	Non prime = { }

2. $[A]^+ = ABCD$

Candidate key A

Prime Attr = A
Non P = BCD

3NF $(X \rightarrow Y) \in F^+$

No partial dependencies

fulfills all conditions of 3NF

but X is not a superkey

for $X \rightarrow Y$ so not BCNF
(ie. $D \rightarrow A$)

1NF

There is a partial dependency
between non prime

$A \rightarrow B, A \rightarrow C$

also each attrb Y not contained
in CK. for $X \rightarrow Y$ ^{$B \rightarrow D$} so

3NF doesn't hold, X also
is not superkey for each FD

3. $[AB]^+ = ABCD$

$[AD]^+ = ABCD$

$[CD]^+ = ABCD$

$[CB]^+ = ABCD$

Candidate keys
AB, AD, CD, CB,

prime attr = ABCD

Non prime = { }

3NF, every $X \rightarrow Y$, Y
is contained in CK.

but $X \rightarrow Y$, there are cases
X is not a super key

(ie. $C \rightarrow A, D \rightarrow B$)