Q1 LRU

2 Points

For the following questions, assume the following page access pattern:

A P R O P E R C O P P E R C O F F E E P O T

Assume you start off with 4 empty buffer frames, and that, when a page is requested, it is brought in and pinned as normal, and then immediately unpinned before the next page request.

Q1.1

Using LRU replacement policy, how many buffer pool hits are there?

6

Q1.2

At the end of this access pattern which pages are left in the buffer pool?

- [ ] A
- [x] P
- [x] O
- [x] E
- [ ] R
- [ ] C
- [ ] F
- [x] T

Q2 MRU

2 Points

For the following questions, assume the following page access pattern:

A P R O P E R C O P P E R C O F F E E P O T

Assume you start off with 4 empty buffer frames, and that, when a page is requested, it is brought in and pinned as normal, and then immediately unpinned before the next page request.

Q2.1

Using MRU replacement policy, how many buffer pool hits are there?

9

Q2.2

At the end of this access pattern which pages are left in the buffer pool?

- [x] A
- [ ] P
- [ ] O
- [x] E
- [x] R
- [ ] C
- [ ] F
- [x] T

Q3 Clock

3 Points

For the following questions, assume the following page access pattern:

A P R O P E R C O P P E R C O F F E E P O T

Assume you start off with 4 empty buffer frames, and that, when a page is requested, it is brought in and pinned as normal, and then immediately unpinned before the next page request.

Q3.1

Using Clock replacement policy, how many buffer pool hits are there?

9

Q3.2

At the end of this access pattern which pages are left in the buffer pool?

- [ ] A
- [x] P
- [ ] O
- [x] E
- [ ] R
- [ ] C
- [x] F
- [x] T

Q3.3

How many reference bits are set at the end of the Clock algorithm?

- (•) 1
- ( ) 2
- ( ) 3
- ( ) 4

Q4 Quick Facts

2 Points

Q4.1

True or False: For any sequential access pattern and buffer size, LRU will always have a cache hit rate strictly less than MRU

- ( ) True
- (•) False

Q4.2

Which of the following statements are true? There may be zero, one, or more than one correct answer.

- [x] After a request is finished, the requester of the page must set the dirty bit if the page was modified.
- [ ] A page in a pool cannot be requested multiple times.
- [ ] Clock policy is a good approximation for MRU
- [x] Evicting a page from the buffer pool where the pin count is nonzero may cause unintended behavior

Q5 Relational Algebra

3 Points

```
CREATE TABLE Users(
uid INTEGER PRIMARY KEY,
uname TEXT,
country TEXT);

CREATE TABLE Artists(
aid INTEGER PRIMARY KEY,
aname TEXT);

CREATE TABLE Albums(
albumid INTEGER PRIMARY KEY,
albumname TEXT,
genre TEXT,
aid INTEGER,
FOREIGN KEY (aid) REFERENCES Artists(aid));
```

```
CREATE TABLE Ratings(
uid INTEGER,
aid INTEGER,
rating INTEGER,
PRIMARY KEY (uid,aid),
FOREIGN KEY (uid) REFERENCES Users(uid),
FOREIGN KEY (aid) REFERENCES Artists(aid));

CREATE TABLE Follows(
uid INTEGER, /* Id of the user doing the following */
fuid INTEGER, /* Id of the user being followed */
FOREIGN KEY (uid) REFERENCES Users(uid),
FOREIGN KEY (fuid) REFERENCES Users(uid));
```

There may be zero, one, or more than one correct answer.

Q5.1 Rated Artists

For each instance of an artist rated by a user, return the name of the user, the name of the artist, and the rating.

- [x] $\pi_{uname,aname,rating}$(Users ⋈ Ratings ⋈ Artists)
- [ ] $\pi_{uname,aname,rating}$(Users ⋈ Artists)
- [ ] $\pi_{uname,aname,rating}$(Users ⋈ Ratings ⋈ $\sigma_{aid\ !=Ratings.aid}$ (Artists))

Q5.2 Tuvan Throat Singing & Modern Pan Flute

Find the name of the artists who have albums of genre ‘Tuvan Throat Singing’ and ‘Modern Pan Flute Music’.

- [ ] $\pi_{Artists.aname}((\sigma_{Albums.genre='Tuvan\ Throat\ Singing'}$ (Albums))) $\cap$ $\pi_{Artists.aname}((\sigma_{Albums.genre='Modern\ Pan\ Flute\ Music'}$ (Albums)))

- [x] $\pi_{Artists.aname}$ $((\sigma_{Albums.genre='Tuvan\ Throat\ Singing'}$ (Albums)) $\bowtie$ Artists) $\cap$ $\pi_{Artists.aname}((\sigma_{Albums.genre='Modern\ Pan\ Flute\ Music'}$ (Albums)) $\bowtie$ Artists)

- [ ] $\pi_{Artists.aname}$ (($\sigma_{Albums.genre='Tuvan\ Throat\ Singing' \wedge Albums.genre='Modern\ Pan\ Flute\ Music'}$ (Albums)) $\bowtie$ Artists)

- [ ] $\pi_{Artists.aname}$ $((\sigma_{Albums.genre='Tuvan\ Throat\ Singing'}$ (Albums))) $\cup$ $\pi_{Artists.aname}((\sigma_{Albums.genre='Modern\ Pan\ Flute\ Music'}$ (Albums)))

Q5.3 Unrated Albums

Return the names of artists who have not been rated by any user.

- [ ] $\pi_{aname}(\pi_{aid,aname}$(Artists) − $\pi_{aid,aname}$(Artists ⋈ Users))

- [x] $\pi_{aname}(\pi_{aid,aname}$(Artists) − $\pi_{aid,aname}$(Artists ⋈ Ratings))

- [x] $\pi_{aname}(\pi_{aid,aname}$(Artists) − $\pi_{aid,aname}$(Artists ⋈ Ratings ⋈ Users))

- [ ] π_{aname}(Ratings − $\pi_{aid,aname}$(Artists ⋈ Ratings ⋈ Users))

[GRADED] Vitamin 4: Buffer Management and Relational Algebra

● GRADED

STUDENT
Somya Mohindra

TOTAL POINTS
12 / 12 pts

QUESTION 1
LRU — **2** / 2 pts

QUESTION 2
MRU — **2** / 2 pts

QUESTION 3
Clock — **3** / 3 pts

QUESTION 4
Quick Facts — **2** / 2 pts

QUESTION 5
Relational Algebra — **3** / 3 pts