

-- 1

$\pi_{Title, Year}(BOOKS)$

```
SELECT Title, Year
FROM BOOKS;
```

-- 2

$\sigma_{Major="CS"}(STUDENTS)$

```
SELECT *
FROM STUDENTS
WHERE Major = "CS";
```

-- 3

$STUDENTS \bowtie borrows$

```
SELECT *
FROM STUDENTS S, borrows B
WHERE S.StID = B.StID;
```

-- 4

$\sigma_{Publisher="McGraw-Hill" \wedge Year < 1990}(BOOKS)$

```
SELECT *
FROM BOOKS
WHERE Publisher = "McGraw-Hill" AND Year < 1990
```

-- 5

$\pi_{AName}(\sigma_{Address="Davis"}(AUTHORS))$

```
SELECT AName
FROM AUTHORS
WHERE Address = "Davis";
```

-- 6

$\pi_{StName}(\sigma_{Age > 30 \wedge Major \neq "CS"}(STUDENTS))$

```
SELECT StName
FROM STUDENTS
WHERE Age > 30 AND Major <> "CS";
```

-- 7

$\rho_{Name/AName}(\pi_{AName}(AUTHORS))$

```
SELECT AName AS Name
FROM AUTHORS;
```

-- 8

$\pi_{StName}(\sigma_{Major="CS"}(STUDENTS \bowtie borrows))$

```
SELECT S.StName
FROM STUDENTS S, borrows B
WHERE S.StID = B.StID
AND S.Major = "CS";
```

-- 9

$\pi_{Title}(\sigma_{AName="Jones"}(BOOKS \bowtie has\ written))$

```
SELECT B.Title
FROM BOOKS B, has-written HW
WHERE B.DocID = HW.DocID
AND HW.AName = "Jones";
```

-- 10

$\pi_{Title}(\sigma_{AName="Jones"}(BOOKS \bowtie has\ written)) -$

$\pi_{Title}(\sigma_{AName="Jones"}(BOOKS \bowtie has\ written) \bowtie \pi_{DocID}(\sigma_{Keyword="database"}(BOOKS \bowtie describes)))$

```

SELECT B.Title
FROM BOOKS B, has-written HW
WHERE B.DocID = HW.DocID
AND HW.AName = "Jones"
AND B.DocID NOT IN (
    SELECT DocID,
    FROM describes
    WHERE Keyword = "database"
);

```

-- 11

USING AGGREGATE FUNCTION:

$$\pi_{StName}(\sigma_{StName = \tau_{MIN(StName)}}(STUDENTS))$$

USING INNER JOIN:

$$\pi_{StName}(STUDENTS) - \pi_{StName}(STUDENTS \bowtie_{Age > Age2} (\rho_{Age/Age2}(STUDENTS)))$$

```

SELECT StName
FROM STUDENTS
WHERE Age = (
    SELECT MIN(Age)
    FROM STUDENTS
);

```

-- 12

USING AGGREGATE FUNCTION:

$$\pi_{Title}(\sigma_{Year = \tau_{MIN(Year)}}(BOOKS))$$

USING INNER JOIN:

$$\pi_{Title}(BOOKS) - \pi_{Title}(BOOKS \bowtie_{Year > Year2} (\rho_{Year/Year2}(BOOKS)))$$

```

SELECT Title
FROM BOOKS
WHERE Title = (

```

```
SELECT MIN(Year)
FROM BOOKS
);
```