Q1

(a)

(1)

$$\pi_{\text{title}}\left(\sigma_{\text{genre}='\text{Novel}'\wedge\text{language}='\text{Chinese}'}(Book)\right) \tag{1}$$

(2)

$$\pi_{name}(\sigma_{gender='Ms.'\wedge dueDate='01-01-2025'}((Customer \bowtie Borrow) \bowtie (\sigma_{genre='Novel'}(Book))) \tag{2}$$

(b)

(1)

```sql
SELECT DISTINCT B.genre
FROM Customer C
JOIN Borrow Br ON C.cID = Br.cID
JOIN Book B ON Br.bID = B.bID
WHERE C.gender = 'Mr.' AND C.age BETWEEN 40 AND 60;
```

(2)

```sql
SELECT B.genre, AVG(C.age) AS average_age
FROM Customer C
JOIN Borrow Br ON C.cID = Br.cID
JOIN Book B ON Br.bID = B.bID
GROUP BY B.genre;
```

Q2

(1)

Access action	Content of Q after access action
visit root	M1(1), M2(2), M3(4)
access M1	m2($\sqrt{2}$), m1(2), M2(2), M3(4)
access m2	a($\sqrt{2}$), m1(2), M2(2), b($\sqrt{5}$), c($\sqrt{8}$), M3(4)
access a	Dissatisfaction
access m1	M2(2), b($\sqrt{5}$), e($\sqrt{5}$), c($\sqrt{8}$), d(4), M3(4)
access M2	m3(2), b($\sqrt{5}$), e($\sqrt{5}$), c($\sqrt{8}$), m4(4), M3(4)
access m3	f(2), b($\sqrt{5}$), e($\sqrt{5}$),c($\sqrt{8}$), g($\sqrt{10}$), m4(4), M3(4)
access f	7 > 6, satisfaction

(2)

Building f is the closest valid building.

Nodes Accessed: **8**(root, M1, m2, a, m1, M2, m3, f).