QUESTION 1

a) The Graph is Disconnected

A disconnected graph means that some entities or relationships in the schema are not linked to others. In terms of an enterprise schema, this suggests that certain parts of the database exist in isolation and cannot interact with others.

Example:
Imagine a university database where:

- One part of the schema contains entities like students, courses, and instructors.
- Another part contains library books and librarians, but there are no relationships connecting students to the library system.

b) The Graph has a Cycle

A cycle in the graph means that a series of relationships connect back to the starting entity, forming a loop.

Example:
In a company database, if:

- An **employee** is related to a **department** (works_in).
- A **department** is related to a **manager** (managed_by).
- The **manager** is also an **employee** in the company.

This forms a cycle because **employee → department → manager → employee**.

QUESTION 3
We have weak entity sets because, in many real-world scenarios, some entities simply cannot exist independently without being associated with another entity. Even though we could technically convert any weak entity set into a strong entity set by adding more attributes, doing so often does not reflect the natural relationships in the data and can lead to redundancy or unnecessary complexity.
Example: Student and Student Dependent in a university database.
We could technically make Student Dependent a strong entity by adding a unique dependent_ID, but that wouldn't make sense in reality. Weak entities exist to model real-world dependencies, avoid redundancy, and maintain logical relationships in the database.

QUESTION 4

A: i

```
SELECT e.ID, e.person_name
FROM employee AS e
JOIN works AS w ON e.ID = w.ID
JOIN company AS c ON w.company_name = c.company_name
WHERE e.city = c.city;
```

ii.

```
SELECT e.ID, e.person_name
FROM employee AS e
JOIN manages AS m ON e.ID = m.ID
JOIN employee AS manager ON m.manager_id = manager.ID
WHERE e.city = manager.city AND e.street = manager.street;
```

iii.

```
SELECT e.ID, e.person_name
FROM employee AS e
JOIN works AS w ON e.ID = w.ID
WHERE w.salary > (
   SELECT AVG(w2.salary)
   FROM works AS w2
   WHERE w2.company_name = w.company_name
);
```

B.

name	title
Brandt	Game Design
Brandt	Game Design
Kim	Intro. to Digital Systems

The rows have been duplicated. The name and title appeared twice.

Solution

```
SELECT DISTINCT name, title
FROM instructor
NATURAL JOIN teaches
NATURAL JOIN section
```

NATURAL JOIN course
WHERE semester = 'Spring' AND year = 2017;

name	title
Brandt	Game Design
Kim	Intro. to Digital Systems