1.

A.

Let .

Thus, there exist an  such that .

If , then . If , then .

Thus, , .

Then we let .

If , then there exists  such that .

Thus, 

Similarly, if , then .

Thus, .

Hence, 

B.

Let .

Thus, there exist an  such that .

Since and , then  and .

Thus, , .

2.

Let , where .

If  is not an integer, .

If  is an integer, then . Thus, .



3.

|  |  |  |
| --- | --- | --- |
|  | domain | range |
| a |  |  |
| b |  |  |
| c | Bit string |  |
| d |  |  |
| e | Bit string | Bit string |

4.

A. Yes.

B. No.

C. No.

D. Yes.

5.

1. 
2. 
3. 

6.

A. 

B. 

C. 

D. 

7.

1. Countably infinite. 
2. Countably infinite. 
3. Countably infinite. Note that . 
4. Countably infinite. Note that . 

8.

1. Countable.
2. Countable.
3. Countably infinite. 
4. Infinite.
5. Countably infinite. 
6. Countably infinite. 

9.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | reflexive | symmetric | Anti-symmetric | transitive |
| a |  | yes |  |  |
| b | yes | yes |  | yes |
| c | yes | yes |  | yes |
| d |  |  | yes |  |
| e | yes | yes |  | yes |
| f |  | yes |  |  |
| g |  |  | yes | yes |
| h |  | yes |  |  |

10.

1. 
2. 
3. 
4. 
5. 