

1 Question 1. (10 points) Finding isomorphism by hand

An isomorphism:

$$\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\} \rightarrow \{a, b, c, g, f, i, h, d, j, e\}$$

2 Question 2. (10 points) Certificate for trees

3 Question 3. (10 points) Reverse the certificate for a tree

4 Question 4. (20 points) Certificate for graphs

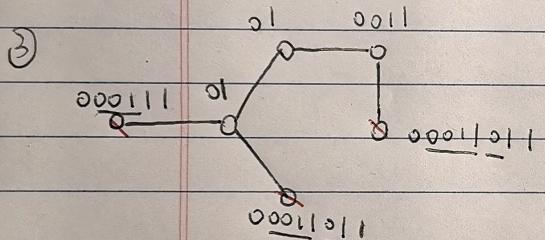
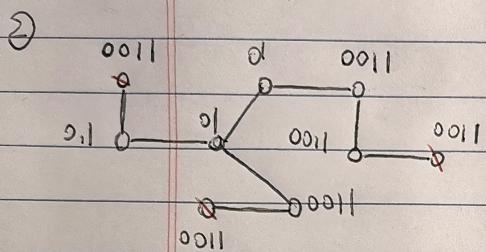
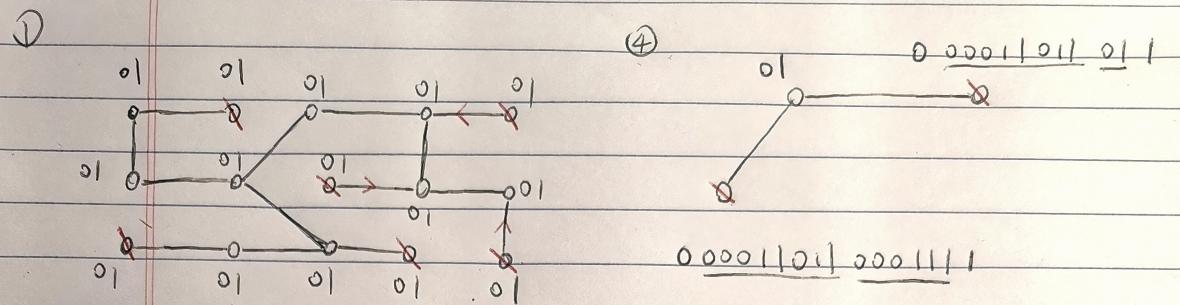


Figure 1: solution to Q2

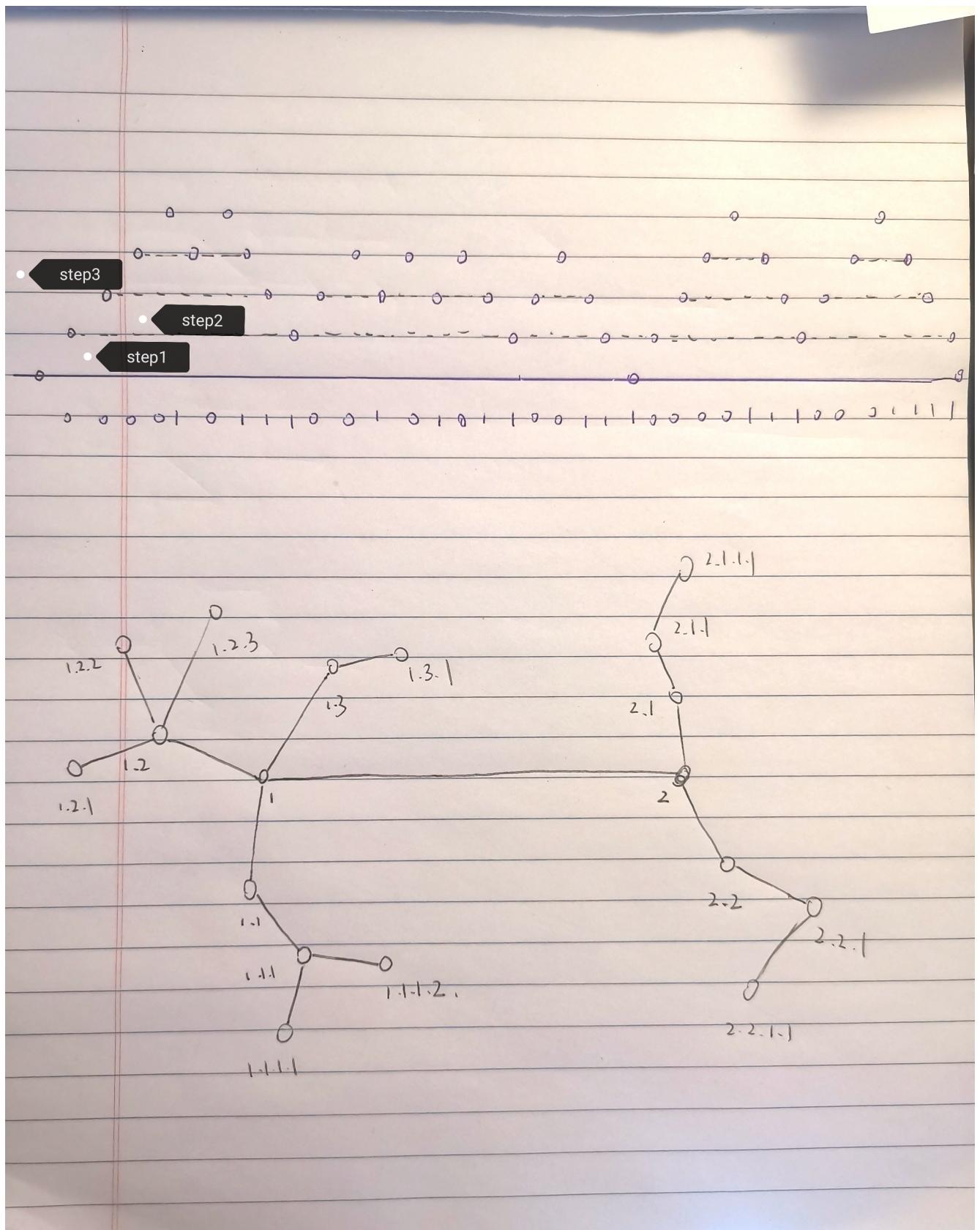
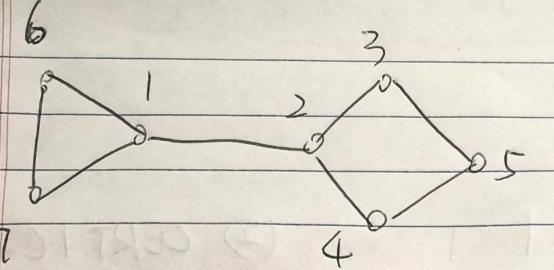


Figure 2: solution to Q3



$$B = \{1 2 3 4 5 6\}$$

① Define (...)

$$D_{(123456)} : B = \{3 4 5 6 7 | 1 2\}$$

$$S = \{3 4 5 6 7 | \underline{1 2}\}$$

$$D_{(12)} : B = \{5 | 3 4 6 7 | 1 2\}$$

$$S = \{3 4 5 6 7 | 3 4 6 7 | \underline{5}\}$$

$$D_{(5)} : B = \{5 | 6 7 | 3 4 | 1 2\}$$

$$S = \{3 4 5 6 7 | 3 4 6 7 | 3 4 | \underline{6 7}\}$$

$$D_{(67)} : B = \{5 | 6 7 | 3 4 | 2 | 1\}$$

$$S = \{3 4 5 6 7 | 3 4 6 7 | 3 4 | 2 | \underline{1}\}$$

$$D_{(1)} : x \dots$$

$$D_{(34)} : x \dots$$

$$D_{(34567)} : x \dots$$

$$D_{(2)} : x \dots$$

$$D_{(3467)} : x \dots$$

No update

$$\Rightarrow B = \{5 | 6 7 | 3 4 | 2 | 1\}$$

$$S = \{\}$$

Figure 3: solution to Q4-1

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5|67|34|2|1 (2) CERTIC...)

did not mention that
need to refine these,
but are already equitable

-1

5|6|7|34|2|1

5|7|6|34|2|1

5|6|7|3|4|2|1

5|6|7|4|3|2|1

5|7|6|3|4|2|1

5|7|6|4|3|2|1

0001100
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equal

equal

~~Cert~~ $\pi = 001100/000000/101100$

Cert = 409817

Figure 4: solution to Q4-2