

Tutorial 2

Functions

Q.1: Encoder of Even Parity

Encoding function f .

- Input: (b_1, b_2, b_3, b_4) , where $b_i \in \{0, 1\} \ \forall i$
- Output: $(c_1, c_2, c_3, c_4, c_5)$, where $c_i \in \{0, 1\} \ \forall i$
 - $c_1 = b_1, c_2 = b_2, c_3 = b_3, c_4 = b_4,$
 - $c_1 + c_2 + c_3 + c_4 + c_5 = 0 \pmod{2}$

- a) What is the domain of f ?
 - Hint: Use Cartesian product.
- b) What is the co-domain of f ?
- c) What is the image of $(0, 1, 0, 0)$?

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d) What is the range of f ?

- 1) $\{0, 1\}^5$
- 2) $\{x \in \{0, 1\}^5 \mid x \text{ has an even number of 1s} \}$
- 3) $\{x \in \{0, 1\}^5 \mid x \text{ has an odd number of 1s} \}$

Q.2: Decoder of Even Parity

Decoding function g .

□ Input: $(c_1, c_2, c_3, c_4, c_5)$, where $c_i \in \{0, 1\} \ \forall i$

□ Output:

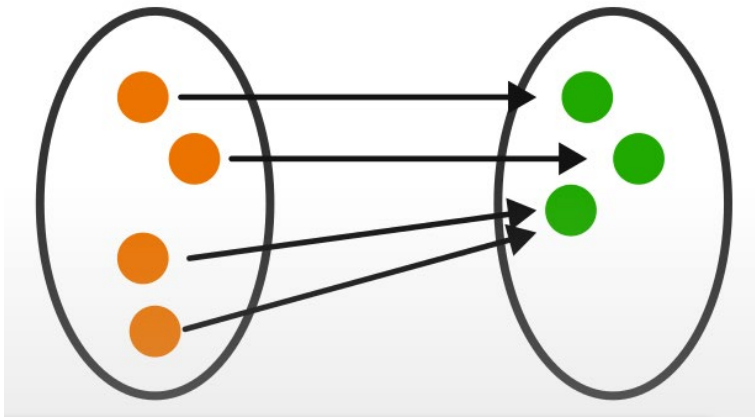
- (c_1, c_2, c_3, c_4) if $c_1 + c_2 + c_3 + c_4 + c_5 = 0 \pmod{2}$
- a special symbol e otherwise

- What is the image of $(0, 1, 0, 0, 1)$?
- What is the image of $(1, 1, 0, 1, 0)$?
- What is the domain of g ?
- What is the co-domain of g ?
 - Hint: Don't forget the special symbol e .

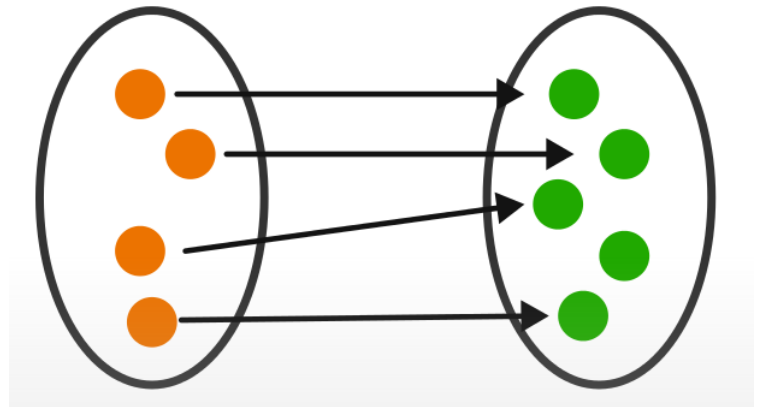
Q.3: Injection & Surjection

□ Is it injection or surjection?

i)



ii)



- a) i) is injection, ii) is surjection
- b) i) is injection, ii) is also injection
- c) i) is surjection, ii) is injection
- d) i) is surjection, ii) is also surjection

Q.4: Composition of Onto Functions

- Suppose $f: X \rightarrow Y$ and $g: Y \rightarrow Z$ are both surjections.
- Is $g \circ f$ a surjection? Prove or disprove it.
 - a) Yes
 - b) No