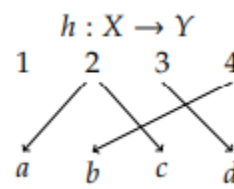
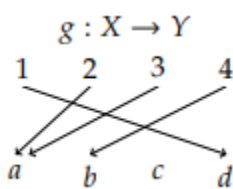
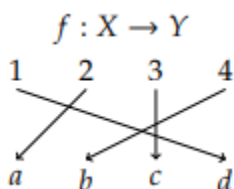


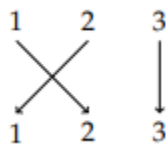
UCS405 (Discrete Mathematical Structures)

Tutorial Sheet-3 (Functions)

- 1 For the function $F : \{1, 2, 3, 4, 5\} \rightarrow \{a, b, c, d, e\}$ defined as $F(1) = a$, $F(2) = b$, $F(3) = b$, $F(4) = d$, and $F(5) = c$, identify $\text{domain}(F)$, $\text{co-domain}(F)$, $\text{range}(F)$, $F^{-1}(a)$, $F^{-1}(\{a, b, c\})$.
- 2 Find the first six values of the function defined on \mathbb{N} given by $F(0) = 2$, $F(1) = 3$, $F(2) = 5$, and $F(n) = 2F(n-1) + 3F(n-2) + F(n-3)$ for $n \geq 3$.
- 3 Which of the following diagrams represent a function? Let $X = \{1, 2, 3, 4\}$ and $Y = \{a, b, c, d\}$.



- 4 Which functions are surjective (i.e., onto)?
 - I. $f : \mathbb{Z} \rightarrow \mathbb{Z}$ defined by $f(n) = 3n$.
 - II. $g : \{1, 2, 3\} \rightarrow \{a, b, c\}$ defined by $g = \{(1, c) (2, a) (3, a)\}$
 - III. $h : \{1, 2, 3\} \rightarrow \{1, 2, 3\}$ defined as follows:



- 5 Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$. Consider the function $f: A \rightarrow B$ defined by $f(x) = \frac{x-2}{x-3}$. Show that f is one-one and onto and hence find f^{-1} .
- 6 Let $f(x) = x + 2$ and $g(x) = 2x + 1$, find $(f \circ g)(x)$ and $(g \circ f)(x)$.
- 7 Consider $f : \mathbb{N} \rightarrow \mathbb{N}$, $g : \mathbb{N} \rightarrow \mathbb{N}$ and $h : \mathbb{N} \rightarrow \mathbb{R}$ defined as $f(x) = 2x$, $g(y) = 3y + 4$ and $h(z) = \sin z$, for x, y and z in \mathbb{N} . Show that $h \circ (g \circ f) = (h \circ g) \circ f$.