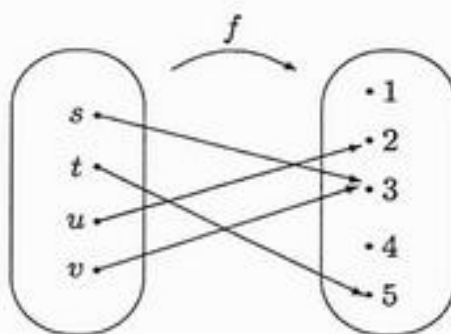(a) A function $f$ is represented by the arrow diagram shown below.



(i) Give the *domain*, *co-domain* and *range* of $f$. [3]

(ii) Say why $f$ does not have the *one-to-one* property and why it does not have the *onto* property, giving a specific counter-example in each case. [2]

(b) (i) State the conditions to be satisfied by a function $f : X \rightarrow Y$ for it to have an inverse function $f^{-1} : Y \rightarrow X$. [2]

(ii) Define $f^{-1}$ when $X = \{1, 2, 3, 4\}$, $Y = \{a, b, c, d\}$, and $f$ is given by the table below.

| $x$ | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $f(x)$ | $b$ | $c$ | $d$ | $a$ |

[3]