0.1 (a) Odd natural numbers.
(b) Even integers.
(c) Even natural numbers.
(d) Even natural numbers and positive multiples of three.
(e) Palendromes.
(f) Empty set.

0.2 (a) $\{1, 10, 100\}$
(b) $\{5, 6, 7, 8, ...\}$, $\{n \in \mathbb{Z} \mid n > 5\}$
(c) $\{0, 1, 2, 3, 4, 5\}$, $\{n \in \mathbb{N} \mid n < 5\}$
(d) $\{\texttt{aba}\}$, $\{w \mid w \text{ is the string } \texttt{aba}\}$
(e) $\{\epsilon\}$, $\{w \mid w \text{ is the empty string}\}$
(f) $\emptyset$

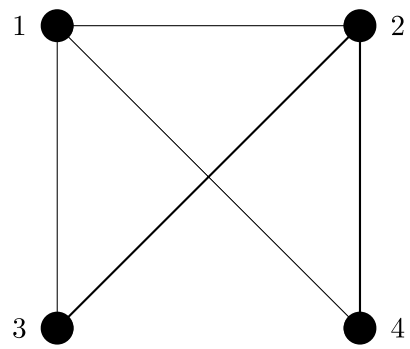
0.3 (a) No.
(b) Yes.
(c) A
(d) B
(e) $\{(x, x), (x, y), (y, x), (y, y), (z, x), (z, y)\}$
(f) $\{\emptyset, \{x\}, \{y\}, \{x, y\}\}$

0.4 (a) $a \times b$
(b) $\sum_{k=0}^{n} \binom{n}{k} = 2^n$

0.5 (a) 7
(b) $\{6, 7\}, \{1, 2, 3, 4, 5\}$
(c) 6
(d) $\{6, 7, 8, 9, 10\}, \{1, 2, 3, 4, 5\} \times \{6, 7, 8, 9, 10\}$
(e) $g(4, f(4)) = g(4, 7) = 8$

0.6 (a) $\approx$
(b) $\leq$
(c) $isAdjacent$

0.7 $deg(1) = 3$, $deg(2) = 3$, $deg(3) = 2$, $deg(4) = 2$

0.8 

0.9 $G = (\{1,2,3,4,5,6\}, \{(1,4),(1,5),(1,6),(2,4),(2,5),(2,6),(3,4),(3,5),(3,6)\})$

0.10 Take a graph $G = (V, E)$, where $|V| \geq 2$. To prove the statement true, we need to show it is not possible to construct G without two vertices having the same degree.

As each edge connects a pair of vertices, the set of all possible degrees for a given vertex $v \in G$ is $D = \{0, 1, \ldots, (|V| - 1)\}$. For the statement to be true, no two vertices may have the same degree, implying a bijection between D and V. Thus, V must include vertices v, u where $D(v) = (|V| - 1)$, $D(u) = 0$. This is a contradiction, which completes the proof.

0.11 The proof only establishes that horses in H_1 and H_2 have the same colour when $|H_1| = |H_2| = 1$. It does not establish that horses in $H_1 \cup H_2$ are the same colour.

0.12 (a) Prove $S(n) = 1 + 2 + \ldots + n = \frac{1}{2}n(n+1)$.

- Base case:

$$S(1) = \frac{1}{2}(1)(2) = 1$$

- Inductive case:

$$\begin{aligned} S(n) &= S(n-1) + n \\ &= \frac{1}{2}(n-1)(n-1+1) + n \\ &= \frac{1}{2}(n^2 + n) \\ &= \frac{1}{2}n(n+1) \end{aligned}$$

(b) Prove $C(n) = 1^3 + 2^3 + \ldots + n^3 = \frac{1}{4}n^2(n+1)^2$.

- Base case:

$$C(1) = \frac{1}{4}(1)^2(2)^2 = 1$$

- Inductive case:

$$\begin{aligned} C(n) &= C(n-1) + n^3 \\ &= \frac{1}{4}(n-1)^2 n^2 + n^3 \\ &= \frac{1}{4}(n^4 - 2n^3 + n^2) + n^3 \\ &= \frac{1}{4}(n^4 + 2n^3 + n^2) \\ &= \frac{1}{4}n^2(n+1)^2 \end{aligned}$$

0.13 Division by $a - b = 0$.

0.14 We let $P_t = 0$ and solve for Y to get the formula: $Y = PM^t(M-1)/(M^t-1)$. For $P = 10^5$, $I = 5 \cdot 10^{-2}$ and $t = 3.6 \cdot 10^2$, we have $M = (1.05/1.2) \cdot 10^{-1}$. We use a calculator to find that $Y \approx \$536.82$ is the monthly payment.

0.15 Make space for two piles of nodes: A and B. Then, starting with the entire graph, repeatedly add each remaining node x to A if its degree is greater than one half the number of remaining nodes and to B otherwise, and discard all nodes to which x isn't (is) connected if it was added to A (B). Continue until no nodes are left. At most half of the nodes are discarded at each of these steps, so at least $\log 2n$ steps will occur before the process terminates. Each step adds a node to one of the piles, so one of the piles ends up with at least $\frac{1}{2}\log 2n$ nodes. The A pile contains the nodes of a clique and the B pile contains the nodes of an anti-clique.