MAS114 Homework Problems

Week 1 (hand in in week 2)

1. Learn the Greek alphabet: learn the names of all the lower-case letters

$$\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, o, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega.$$

(They're among the commonest of the unfamiliar symbols that mathematicians use. If you're Greek or Cypriot, you have an advantage, but you should probably get used to the unusual way their names are pronounced in English.)

2. Which of the following rules define a function? For those that are functions, are they injective? Are they surjective? Are they bijective? Give brief explanations where necessary.

   (i) $f : \mathbb{N} \to \mathbb{R}$ defined by $f(n) = \sqrt{n}$;

   (ii) $g : \mathbb{Z} \to \mathbb{R}$ defined by $g(n) = \sqrt{n}$;

   (iii) $h : \mathbb{Z} \to \mathbb{N}$ defined by $h(n) = |n|$;

   (iv) $i : \mathbb{N} \to \mathbb{N}$ defined by taking $i(n) = 100 - n$.

   (v) $j : \mathbb{Z} \to \mathbb{Z}$ defined by $j(n) = -n$;

   (vi) $k : \mathbb{R} \to \mathbb{Z}$ defined by taking $k(x)$ to be the closest integer to x.

3. **Challenge:** How many subsets are there of $\{1, 2, 3, \ldots, 19, 20\}$ which contain no two consecutive elements? (For example, $\{1, 4, 18\}$ is okay, but $\{1, 4, 17, 18\}$ is not okay since it contains the consecutives 17 and 18.)

   [*Please hand in attempts to the Challenge problem on a separate sheet of paper so they can make their way to Dr Cranch more easily.*]