MAT1830 - Discrete Mathematics for Computer Science
Assignment #5

To be handed in at the beginning of your support class in week 7 (10 – 13 April)

If you're missing out on your usual support class on Fri 14 Apr, you can submit your assignment to me at a lecture in week 7 or under the door of my office (9Rnf/418) by 2pm Thu 13 Apr. Please clearly mark your support class day, time and room on your assignment.

Let $A = \mathcal{P}(\{1,2,3,4\})$. Let f, g and h be the following functions.

$f : A \to A$ defined by $f(X) = X \cap \{3,4\}$.

$g : A \to \mathbb{Z}$ defined by $g(X) = \begin{cases} -1 & \text{if } X = \{\} \\ \text{the greatest element of } X & \text{if } X \neq \{\} \end{cases}$

$h : \{1,2,3,4\} \to A$ defined by $h(x) = \{1,2,3,4\} - \{x\}$.

1. (i) What is $f(\{2,3,4\})$?
   (ii) What is $g(\{1,2,3\})$?
   (iii) What is $h(4)$?
   (iv) What is $f \circ h(3)$?

2. (i) Is f one-to-one?
   (ii) Is g one-to-one?
   (iii) Is h one-to-one?

3. (i) What is the range of f?
   (ii) What is the range of g?
   (iii) What is the range of h?

4. (i) Does $f \circ g$ exist? If $f \circ g$ does exist, what is its domain, codomain, and range?
   (ii) Does $g \circ f$ exist? If $g \circ f$ does exist, what is its domain, codomain, and range?

Note: Answers only are required for Question 1, but you should fully justify your answers for the other questions.