

**Assignment 2**

**Due Monday 15 October, 15:00** (in supervisor pigeon hole)

1. State which of the following properties is satisfied by the sequences below: *increasing, strictly increasing, decreasing, strictly decreasing, monotonic, non-monotonic, bounded above, bounded below, bounded*. Do not omit any property, even if it is obvious! For all examples below,  $n \geq 1$ .

(a)  $a_n = \frac{1}{n+12}$

(b)  $b_n = \frac{(n+1)^3}{n^2+1}$

(c)  $c_n = \frac{n-6}{n+8}$

(d)  $d_n = \cos n$

(e)  $e_n = \frac{1}{2^n}$

(f)  $f_n = 3^{\sin(n\pi)}$

(g)  $g_n = \cos \frac{1}{n}$

(h)  $h_n = (-1)^n n^2$

2. Consider the sequence

$$a_1 = \frac{1}{2}, \quad a_{n+1} = \frac{1}{2 + a_n}.$$

Write down the first 5 terms of this sequence. Is this sequence bounded? increasing? decreasing?

3. In each of the following cases give an example of a sequence  $(a_n)$  with the stated properties.

- (i) Strictly increasing and bounded above
- (ii) Not bounded above and not bounded below
- (iii) Increasing and decreasing
- (iv) Non-monotonic and bounded
- (v) Not increasing and not bounded
- (vi) Bounded above and not decreasing