

**Instructions**

- Answer each question completely; justify your answers.
  - This assignment is due at 15:00 on Friday February 1st in Assignment Box #48.
1. Prove that if there exists a  $\text{PBD}(v, \{k, 3\}, 1)$  with  $v \equiv 2 \pmod{3}$  then  $k \equiv 2 \pmod{3}$ .
  2. Prove that no  $\text{PBD}(8, \{4, 3\}, 1)$  can exist.
  3. Prove that there is no  $\text{PBD}(v, \{4, 3\}, 1)$  when  $v \equiv 2 \pmod{3}$ .
  4. Prove that there cannot be any blocks of size 5 in a  $\text{PBD}(7, \{5, 4, 3\}, 1)$ . Can there be any blocks of size 4?
  5. Prove there exists a  $\text{BIBD}(7(3^t), 3, 1)$  for each integer  $t \geq 0$ .