# COMP523 Tutorial 6

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## Problem 1

Consider the *Open pit mining* problem: There is a set of blocks to be mined, each with a cost $c_i$ and a payoff $p_i$ and in order to mine two blocks $i$ and $i'$, it is required to first mine the block $j$ directly above them. The goal is to find a set $S$ of blocks to mine in order to maximise the profit $\sum_{i \in S}(p_i - c_i)$.

Formulate the problem as a maximum flow problem and explain how to use a solution to the maximum flow problem in order to obtain a solution to the open pit mining problem.

## Problem 2

Recall that a $k$-colouring of a graph $G$ is a function $f : V \rightarrow \{1, 2, \ldots, k\}$ mapping nodes to *colours*, such that for any nodes $u$ and $v$ such that $(u, v) \in E$, it holds that $f(u) \neq f(v)$.

Consider the 3-colouring problem: Given a graph $G$ as input, decide whether there is a 3-colouring of $G$. Prove that 3-colouring is NP-complete.