

## 4.4.5 Optimal project selection

$$G = (P, A)$$

$$g: P \rightarrow \mathbb{Z}$$

$g(v) \geq 0$  : profit

$g(v) < 0$  : cost

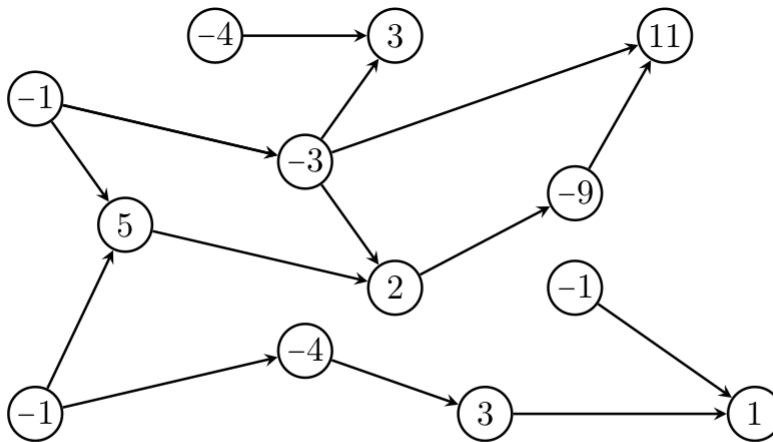
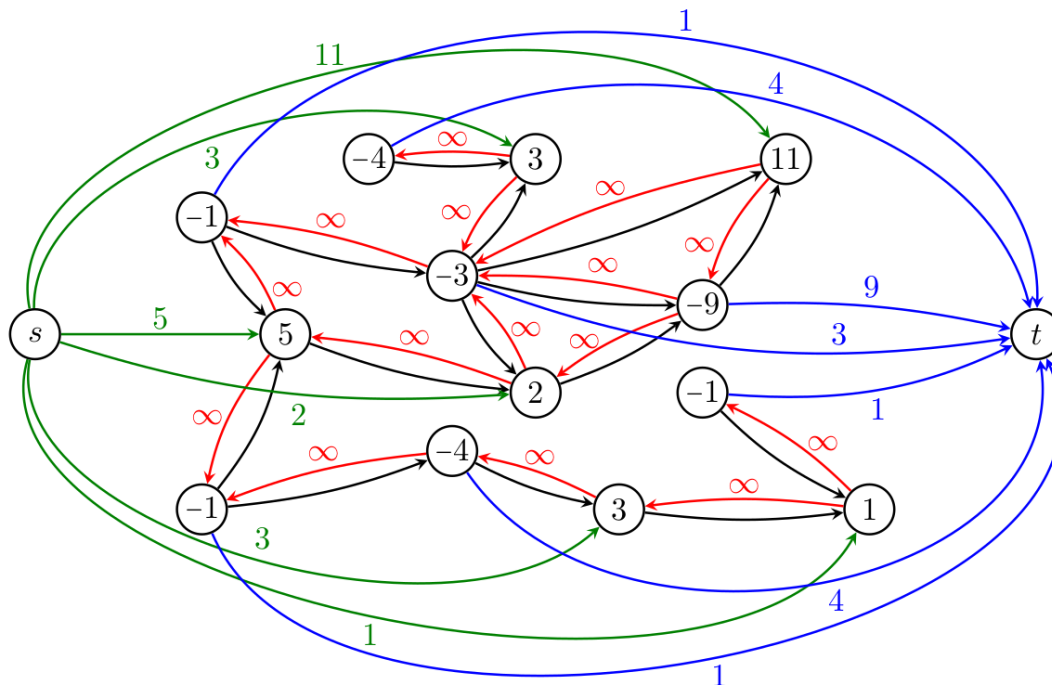
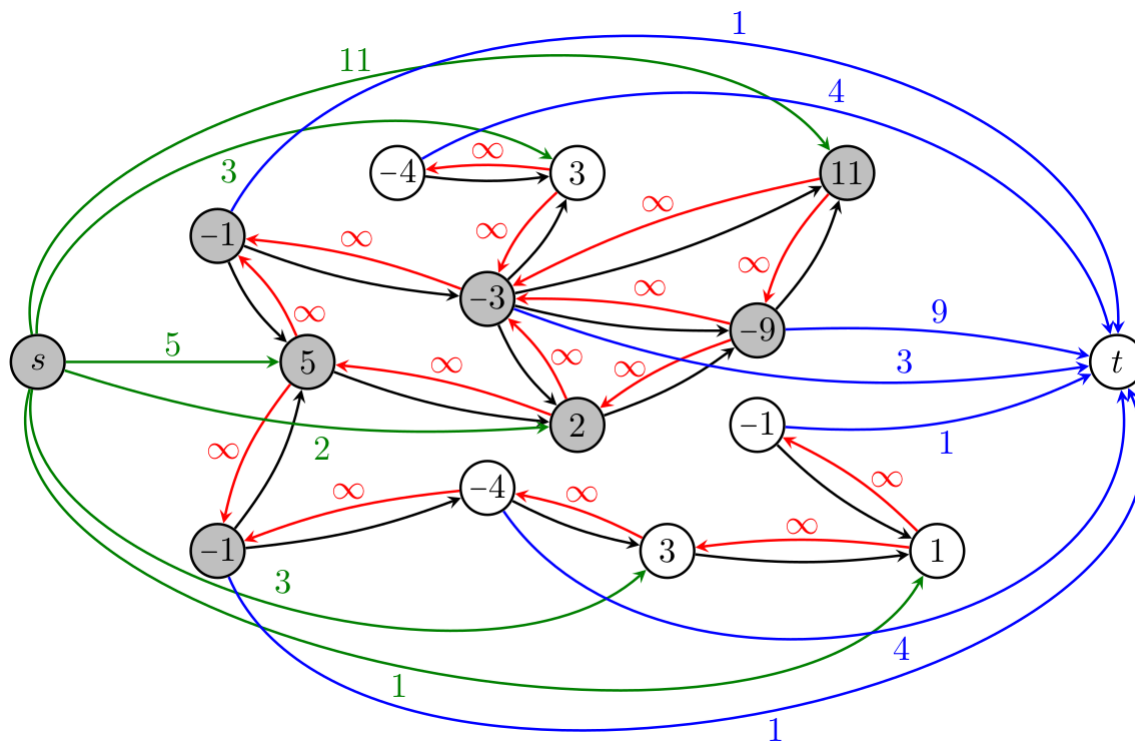


Figure 4.11: A graph  $G$  with projects and their precedence constraints. Profits (or costs) are indicated in the corresponding vertices.

## Modeling as a minimum s-t cut problem





A minimum  $s$ - $t$  cut in auxiliary graph is indeed an optimal solution

#### 4.4.6 Open pit mining

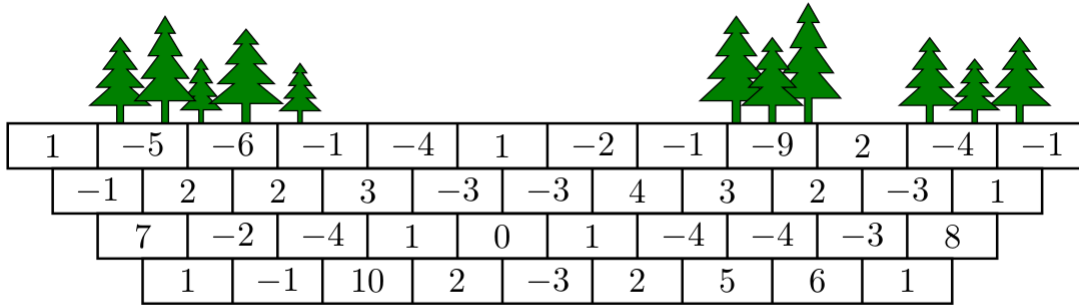


Figure 4.14: A possible soil profile with respective profits.

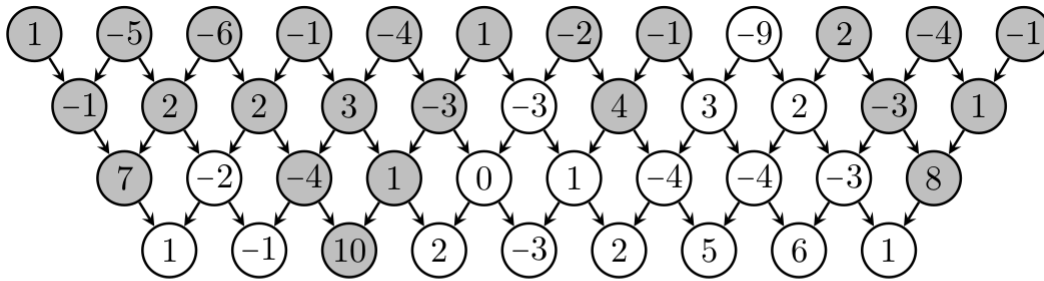
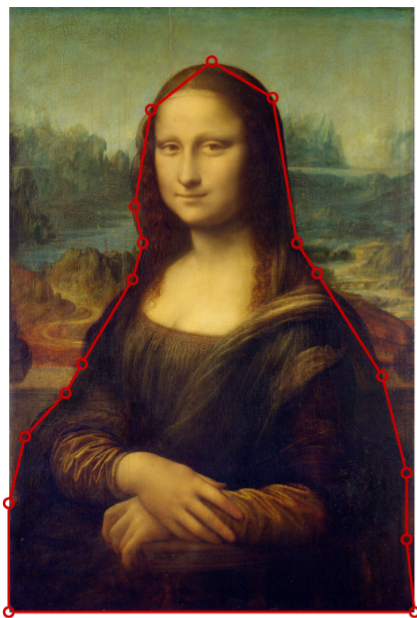


Figure 4.15: Reduction of the open pit mining problem shown in Figure 4.14 to an optimal project selection problem. The gray vertices correspond to an optimal solution.

## 4.4.7 Image segmentation



(a) The Mona Lisa of Leonardo da Vinci together with a manual selection.



(b) The foreground of the Mona Lisa, extracted due to color differences and manual selection.

Figure 4.16: Extraction of the foreground from an image.

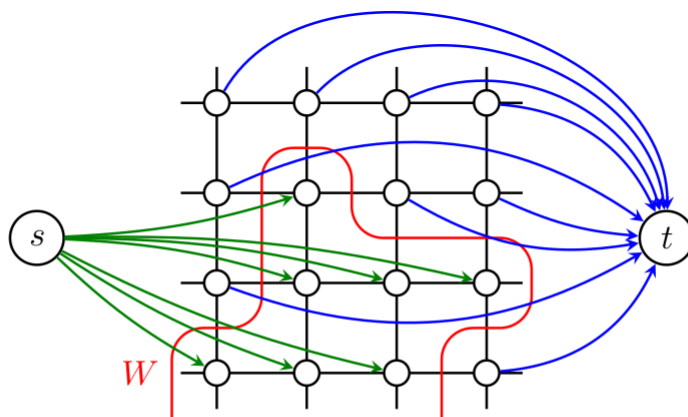


Figure 4.17: Excerpt of an image with manual segmentation  $W$  shown in red. The arcs  $(s, p)$  are shown in green and arcs  $(p, t)$  are highlighted in blue. Each of these colored arcs has equal capacity  $x \in \mathbb{Z}_{\geq 0}$ .

$$u((p_1, p_2)) := 765 - \|(r_1, g_1, b_1) - (r_2, g_2, b_2)\|_1$$

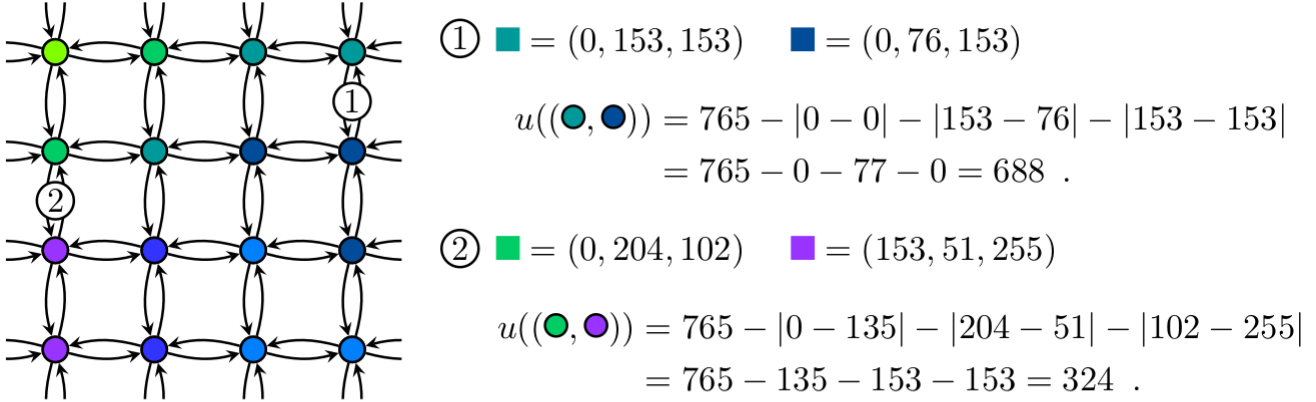
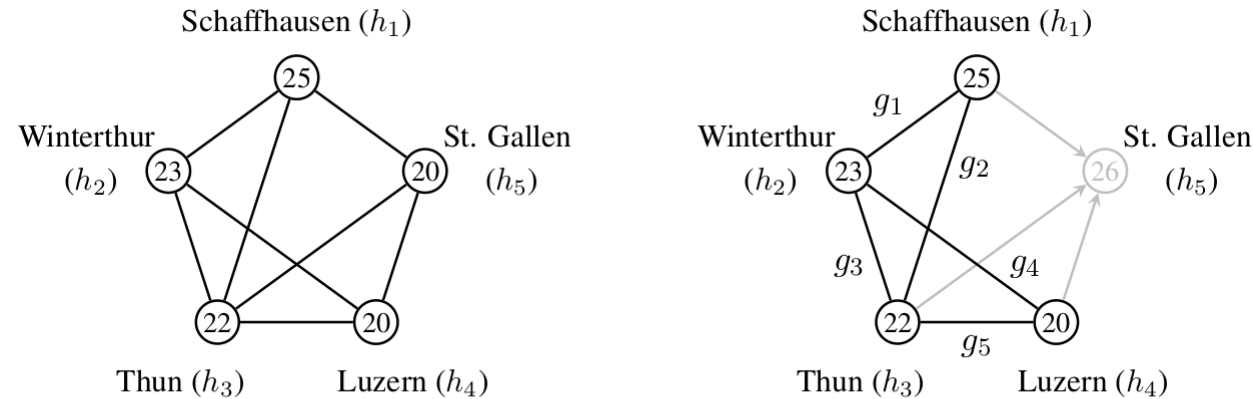


Figure 4.18: Calculation of color difference of adjacent pixels using two examples. The greater the color difference, the smaller the capacity  $u$  on the corresponding arcs.

4.4.8 Theoretical winning possibilities in sports competitions

rank	team	remaining games	points
1.	Schaffhausen	3	25
2.	Winterthur	3	23
3.	Thun	4	22
4.	Luzern	3	20
5.	St. Gallen	3	20
$\vdots$	$\vdots$	$\vdots$	$\vdots$

Table 4.1: A possible (partial) handball table.



- (a) Remaining matches between teams: Each edge corresponds to one match.
- (b) If we assume that St. Gallen wins all its games, then the 5 games  $g_1, \dots, g_5$  remain.

Figure 4.19: Remaining games displayed as a graph.

