Advanced Algorithms & Data Structures
Assignment 1

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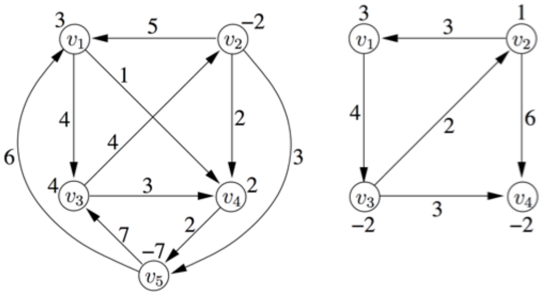
Contents

1 *b*-flow

Find for each of the two graphs in Figure 1, a b-flow for the graph or argue that the graph has no b-flow



(a) (b)

For a directed graph $G = (V, E)$. For each vertex $v \in V$ let $\delta^+(v)$ be the set of outgiong edges from v and $\delta^-(v)$ be the set of incoming edges to v.
Given is that each a b-flow under the following constraints

$$\sum_{e \in \delta^-(v)} x_e - \sum_{e \in \delta^+(v)} x_e = b_v, \forall v \in V \tag{1}$$

$$0 \leq x_e \leq u_e, \forall e \in E \tag{2}$$

Given these constraints we find that the following b-flows exist for graph (a)

$$\delta(v_2 v_4) = 2$$
$$\delta(v_5 v_3) = 4$$
$$\delta(v_5 v_1) = 3$$

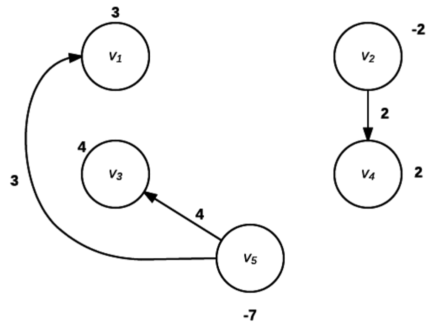


Figure 1: Graph 1A b-flow

We find that there is no b-flow in graph (b) as there is no outgoing edge from v_4 and we do not allow for negative flows. Thus only some of the nodes can satisfy equations (1) and (2) resulting in no existing b-flow.

2 Rectilinear Planar Embedding

2.1 Exercise 2.1

Table 1 shows the values for x_{vf} that correspond to Figure 3 from the Assignment Document.

x_{vf}	a	b	c	d	e
v_1	0	1	1	0	0
v_2	0	0	1	1	0
v_3	1	0	1	1	1
v_4	0	0	0	-1	1
v_5	1	0	0	0	-1
v_6	1	1	0	1	1
v_7	0	0	0	0	0

Table 1: x_{vf} values for Figure 3 in Assignment Document

Table 2 shows the values for z_{fg} that correspond to Figure 3 from the Assignment Document. There are 13 break-points in this graph.

z_{fg}	a	b	c	d	e
a	-	0	0	0	0
b	2	-	1	1	0
c	1	1	-	0	0
d	0	1	0	-	
e	4	0	0	0	-

Table 2: z_{fg} values for Figure 3 in Assignment Document