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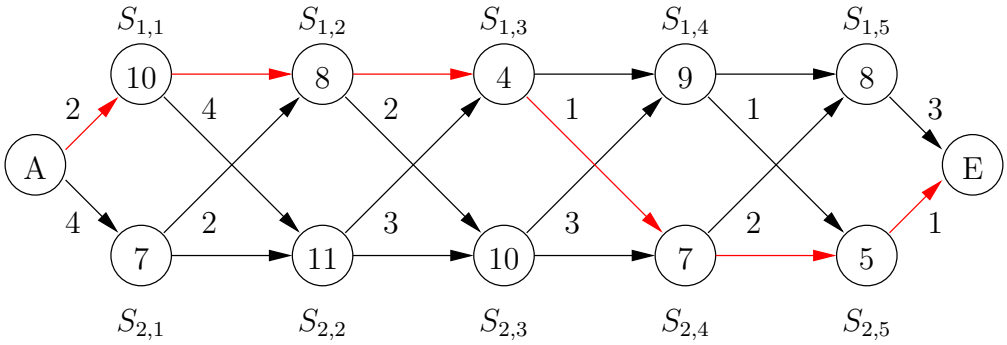
Klausur Algorithmen und Datenstrukturen 3 (WS 2008/2009)

Lösungshinweise

(Alle Angaben ohne Gewähr)

Aufgabe 1.

a) Das Fertigungsplanungsproblem als gerichteter Graph inklusive Lösung:



b) Die berechnete Lösung:

j	1	2	3	4	5	Ende
$f_1[j]$	12	20	24	33	41	44
$f_2[j]$	11	22	32	32	37	38
$\ell_1[j]$	–	1	1	1	1	1
$\ell_2[j]$	–	2	2	1	2	2

Aufgabe 2.

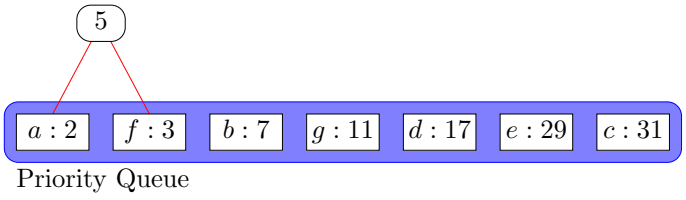
a) $m = 2048$, $A = \frac{\sqrt{5}-1}{2}$, $k = 10000$:

$$\begin{aligned} h(k) &= \lfloor (k \cdot A - \lfloor k \cdot A \rfloor) \cdot m \rfloor \\ h(10000) &= \left\lfloor \left(10000 \cdot \frac{\sqrt{5}-1}{2} - \left\lfloor 10000 \cdot \frac{\sqrt{5}-1}{2} \right\rfloor \right) \cdot 2048 \right\rfloor \\ &= 696 \end{aligned}$$

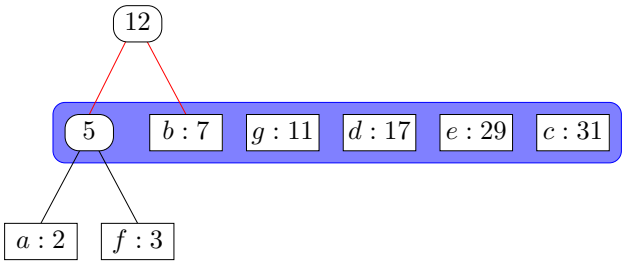
b) $h_1(103) = 12$, $h_2(103) = 8$:

$$\begin{aligned} h(103,0) &= (12 + 0 \cdot 8) \bmod 13 = 12 \\ h(103,1) &= (12 + 1 \cdot 8) \bmod 13 = 7 \\ h(103,2) &= (12 + 2 \cdot 8) \bmod 13 = 2 \\ h(103,3) &= (12 + 3 \cdot 8) \bmod 13 = 10 \\ h(103,4) &= (12 + 4 \cdot 8) \bmod 13 = 5 \\ h(103,5) &= (12 + 5 \cdot 8) \bmod 13 = 0 \\ h(103,6) &= (12 + 6 \cdot 8) \bmod 13 = 8 \\ h(103,7) &= (12 + 7 \cdot 8) \bmod 13 = 3 \\ h(103,8) &= (12 + 8 \cdot 8) \bmod 13 = 11 \\ h(103,9) &= (12 + 9 \cdot 8) \bmod 13 = 6 \\ h(103,10) &= (12 + 10 \cdot 8) \bmod 13 = 1 \\ h(103,11) &= (12 + 11 \cdot 8) \bmod 13 = 9 \\ h(103,12) &= (12 + 12 \cdot 8) \bmod 13 = 4 \end{aligned}$$

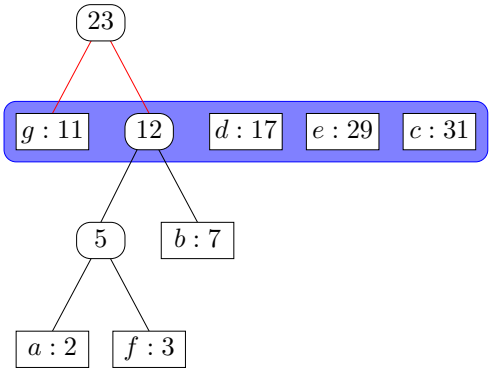
Aufgabe 3.
Schritt 1:



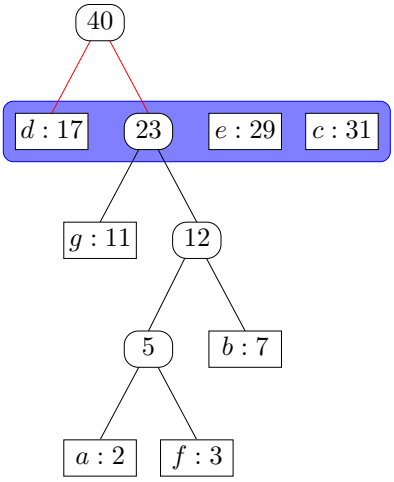
Schritt 2:



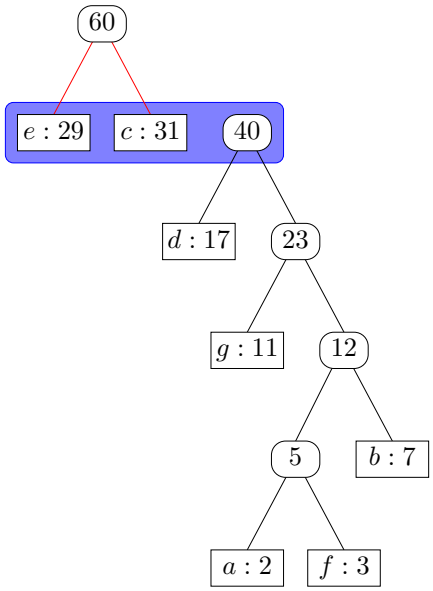
Schritt 3:



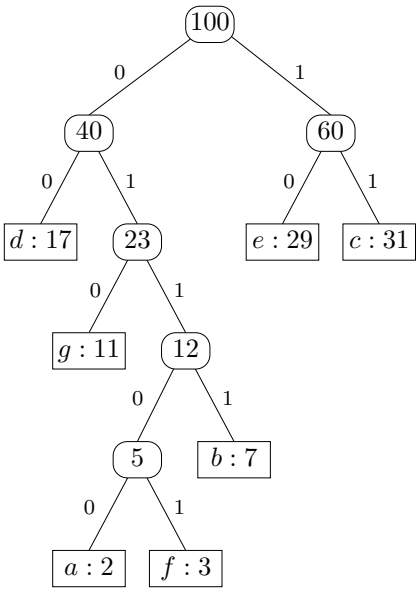
Schritt 4:



Schritt 5:



Schritt 6:



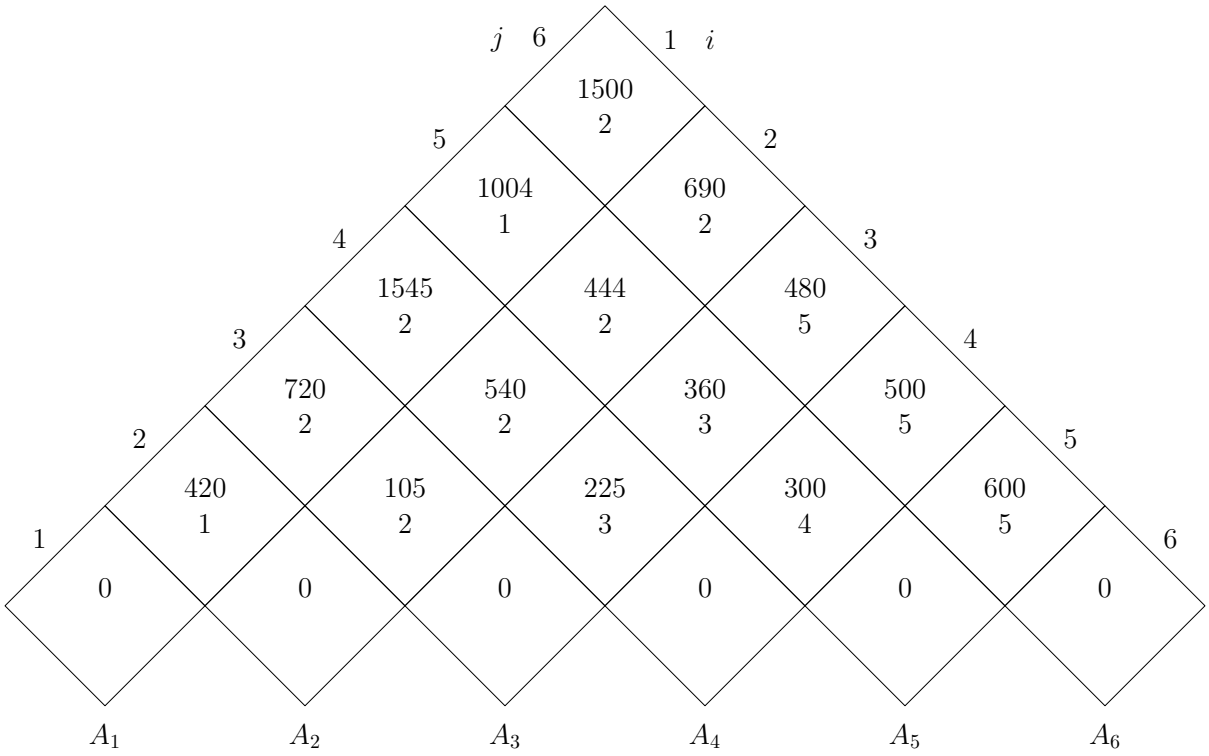
Ergebnis:

Buchstabe	*Kodewort*
a	01100
b	0111
c	11
d	00
e	10
f	01101
g	010

Aufgabe 4.

Knoten		u	v	w	x	y	z
	d	0	∞	∞	∞	∞	∞
	π	$-$	$-$	$-$	$-$	$-$	$-$
u	d	0	15	∞	4	∞	∞
	π	$-$	u	$-$	u	$-$	$-$
x	d	0	15	13	4	6	∞
	π	$-$	u	x	u	x	$-$
y	d	0	15	11	4	6	16
	π	$-$	u	y	u	x	y
w	d	0	12	11	4	6	14
	π	$-$	w	y	u	x	w
v	d	0	12	11	4	6	14
	π	$-$	w	y	u	x	w
z	d	0	12	11	4	6	14
	π	$-$	w	y	u	x	w

Aufgabe 5. Die vollständige Tabelle ist:


j 6
1 i
1500
2
5
2
1004
1
690
2
4
3
1545
2
444
2
480
5
3
4
720
2
540
2
360
3
500
5
2
5
420
1
105
2
225
3
300
4
600
5
1
6
0
0
0
0
0
0
A1
A2
A3
A4
A5
A6

a) $i = 4, j = 5$: $5 \cdot 15 \cdot 4 = 300$

b) $i = 1, j = 5$:

$$\begin{aligned} k = 1: &\quad 0 + 444 + 20 \cdot 7 \cdot 4 &= 1004 \\ k = 2: &\quad 420 + 360 + 20 \cdot 3 \cdot 4 &= 1020 \\ k = 3: &\quad 720 + 300 + 20 \cdot 5 \cdot 4 &= 1420 \\ k = 4: &\quad 1545 + 0 + 20 \cdot 15 \cdot 4 &= 2745 \end{aligned}$$

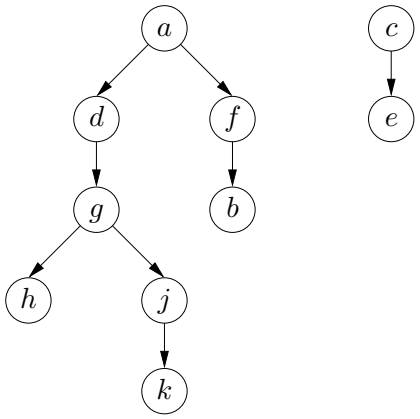
c) Die optimale Klammerung ist: $(A_1A_2)((A_3(A_4A_5))A_6)$.

Aufgabe 6.

a) Die von der Tiefensuche berechneten Werte sind:

v	$\pi[v]$	$d[v]$	$f[v]$
a	$-$	1	16
d	a	2	11
g	d	3	10
h	g	4	5
j	g	6	9
k	j	7	8
f	a	12	15
b	f	13	14
c	$-$	17	20
e	c	18	19

b) DFS-Wald G:



Aufgabe 7.

a) Sortierung der Kanten:

Kante	*Gewicht*
(e,h)	1
(f,g)	2
(d,g)	4
(f,m)	5
(a,e)	7
(d,e)	8
(k,j)	9
(h,c)	10
(b,d)	13

Kante	*Gewicht*
(g,k)	14
(c,j)	15
(h,k)	16
(g,m)	17
(m,j)	18
(b,f)	19
(a,b)	20
(d,f)	21
(a,c)	23

b) Der Algorithmus von Kruskal führt folgende Rechenschritte durch:

Kante	*Teilmengen*
–	$\{a\}\ \{b\}\ \{c\}\ \{d\}\ \{e\}\ \{f\}\ \{g\}\ \{h\}\ \{j\}\ \{k\}\ \{m\}$
(e,h)	$\{a\}\ \{b\}\ \{c\}\ \{d\}\ \{e,h\}\ \{f\}\ \{g\}\ \{j\}\ \{k\}\ \{m\}$
(f,g)	$\{a\}\ \{b\}\ \{c\}\ \{d\}\ \{e,h\}\ \{f,g\}\ \{j\}\ \{k\}\ \{m\}$
(d,g)	$\{a\}\ \{b\}\ \{c\}\ \{d,f,g\}\ \{e,h\}\ \{j\}\ \{k\}\ \{m\}$
(f,m)	$\{a\}\ \{b\}\ \{c\}\ \{d,f,g,m\}\ \{e,h\}\ \{j\}\ \{k\}$
(a,e)	$\{a,e,h\}\ \{b\}\ \{c\}\ \{d,f,g,m\}\ \{j\}\ \{k\}$
(d,e)	$\{a,d,e,f,g,h,m\}\ \{b\}\ \{c\}\ \{j\}\ \{k\}$
(k,j)	$\{a,d,e,f,g,h,m\}\ \{b\}\ \{c\}\ \{j,k\}$
(h,c)	$\{a,c,d,e,f,g,h,m\}\ \{b\}\ \{j,k\}$
(b,d)	$\{a,b,c,d,e,f,g,h,m\}\ \{j,k\}$
(g,k)	$\{a,b,c,d,e,f,g,m,j,k\}$

Der Graph G inklusive minimal aufspannendem Baum: