W4 - IPS

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Task 1

SubExp	I/O?	Elim?	UsedVars	OptSubExp
1	no	-	u	u
2	no	-	x	x+x
3	yes	-	x	foo(x)
4	no	-		7
5	yes	no	x	let x=foo(x) in 7
6	no	-	x,u	x+u
7	no	-	y,x	y*x
8	no	yes	y,x	y*x
9	yes	no	x	let y=(let x=foo(x) in 7) in y*x
10	yes	yes	x	let y=(let x=foo(x) in 7) in y*x
11	yes	no	u	let x=u in let y=(let x=foo(x) in 7) in y*x

Task 2

a)

i	succ[i]	gen[i]	kill[i]
1	2		
2	3,7	a,b	
3	4		
4	5	a	t
5	6	b	a
6	7	t	b
7	8		
8	9		z
9	10	a,b	b
10	1,11	b,z	
11	12		
12		a	

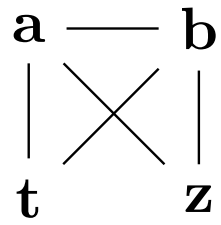
b)

	Initial		Iteration 1		Iteration 2		Iteration 3	
i	out[i]	in[i]	out[i]	in[i]	out[i]	in[i]	out[i]	in[i]
1			a,b	a,b	a,b	a,b	a,b	a,b
2			a,b	a,b	a,b	a,b	a,b	a,b
3			a,b	a,b	a,b	a,b	a,b	a,b
4			b,t	a,b	b,t	a,b	b,t	a,b
5			a,t	b,t	a,t	b,t	a,t	b,t
6			a,b	a,t	a,b	a,t	a,b	a,t
7			a,b	a,b	a,b	a,b	a,b	a,b
8			a,b,z	a,b	a,b,z	a,b	a,b,z	a,b
9			a,b,z	a,b,z	a,b,z	a,b,z	a,b,z	a,b,z
10			a	a,b,z	a,b	a,b,z	a,b	a,b,z
11			a	a	a	a	a	a

c)

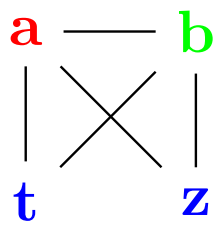
i	kill[i]	out[i]	Interferes with
4	t	b,t	b
5	a	a,t	t
6	b	a,b	a
8	z	a,b,z	a,b
9	b	a,b,z	a,z

d)



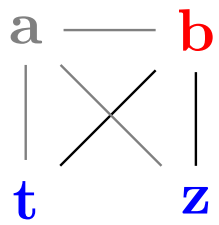
e)

Node	Neighbors	Color
z		1
b	z	2
a	b,z	3
t	a,b	1



f)

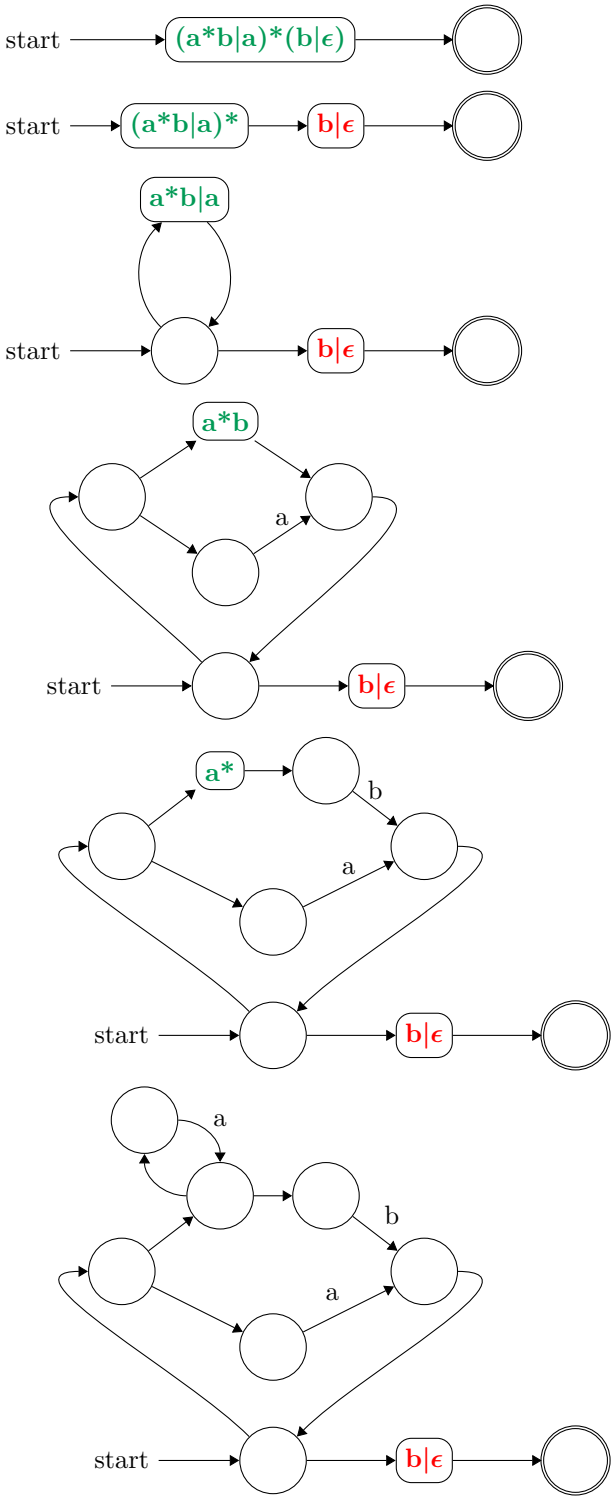
Node	Neighbors	Color
z		1
b	z	2
t	b	1
a	b,t,z	spill

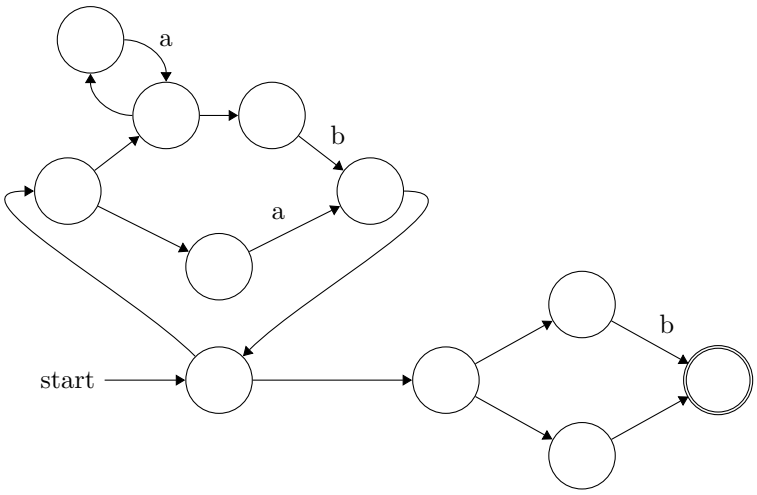



```
1    gcd(a,b) {
2     M[addra] := a
3  1:  LABEL start
4     a2 := M[addra]
5  2:  IF a2 < b THEN next ELSE swap
6  3:  LABEL swap
7     a4 := M[addra]
8  4:  t := a4
9  5:  a5 := b
10    M[addra] := a5
11 6:  b := t
12 7:  LABEL next
13 8:  z := 0
14    a9 := M[addra]
15 9:  b := b mod a9
16 10: IF b = z THEN end ELSE start
17 11: LABEL end
18    a := M[addra]
19 12: RETURN a
20   }
```

Task 3

Edges without a label should be assumed to be labeled with ϵ.





Task 4

state	epsilon-closure	complete
0	{1,2,4}	

$$
\begin{aligned}
move(s'_0, \mathtt{a}) &= \epsilon\text{-closure}(\{t | s \in \{1,2,4\} \text{ and } s^{\mathtt{a}}t \in T\}) \\
&= \epsilon\text{-closure}(\{3,4\}) \\
&= \{3,4,6\} \\
&= s'_1
\end{aligned} \tag{1}
$$

$$
\begin{aligned}
move(s'_0, \mathtt{b}) &= \epsilon\text{-closure}(\{t | s \in \{1,2,4\} \text{ and } s^{\mathtt{b}}t \in T\}) \\
&= \epsilon\text{-closure}(\{5\}) \\
&= \{4,5,6\} \\
&= s'_2
\end{aligned} \tag{2}
$$

state	epsilon-closure	complete
0	{1,2,4}	✓
1	{3,4,6}	
2	{4,5,6}	

$$
\begin{aligned}
move(s'_1, \mathtt{a}) &= \epsilon\text{-closure}(\{t | s \in \{3,4,6\} \text{ and } s^{\mathtt{a}}t \in T\}) \\
&= \epsilon\text{-closure}(\{4\}) \\
&= \{4\} \\
&= s'_3
\end{aligned} \tag{3}
$$

$$
\begin{aligned}
move(s'_1, \mathtt{b}) &= \epsilon\text{-closure}(\{t | s \in \{3,4,6\} \text{ and } s^{\mathtt{b}}t \in T\}) \\
&= \epsilon\text{-closure}(\{3,5\}) \\
&= \{3,4,5,6\} \\
&= s'_4
\end{aligned} \tag{4}
$$

state	epsilon-closure	complete
0	{1,2,4}	✓
1	{3,4,6}	✓
2	{4,5,6}	
3	{4}	
4	{3,4,5,6}	

$$\begin{aligned} move(s'_2, \mathtt{a}) &= \epsilon\text{-closure}(\{t | s \in \{4,5,6\} \text{ and } s^{\mathtt{a}}t \in T\}) \\ &= \epsilon\text{-closure}(\{4\}) \\ &= \{4\} \\ &= s'_3 \end{aligned} \tag{5}$$

$$\begin{aligned} move(s'_2, \mathtt{b}) &= \epsilon\text{-closure}(\{t | s \in \{4,5,6\} \text{ and } s^{\mathtt{b}}t \in T\}) \\ &= \epsilon\text{-closure}(\{5\}) \\ &= \{4,5,6\} \\ &= s'_2 \end{aligned} \tag{6}$$

state	epsilon-closure	complete
0	{1,2,4}	✓
1	{3,4,6}	✓
2	{4,5,6}	✓
3	{4}	
4	{3,4,5,6}	

$$\begin{aligned} move(s'_3, \mathtt{a}) &= \epsilon\text{-closure}(\{t | s \in \{4\} \text{ and } s^{\mathtt{a}}t \in T\}) \\ &= \epsilon\text{-closure}(\{4\}) \\ &= \{4\} \\ &= s'_3 \end{aligned} \tag{7}$$

$$\begin{aligned} move(s'_3, \mathtt{b}) &= \epsilon\text{-closure}(\{t | s \in \{4\} \text{ and } s^{\mathtt{b}}t \in T\}) \\ &= \epsilon\text{-closure}(\{5\}) \\ &= \{4,5,6\} \\ &= s'_2 \end{aligned} \tag{8}$$

state	epsilon-closure	complete
0	{1,2,4}	✓
1	{3,4,6}	✓
2	{4,5,6}	✓
3	{4}	✓
4	{3,4,5,6}	

$$\begin{aligned} move(s'_4, \mathtt{a}) &= \epsilon\text{-closure}(\{t | s \in \{3,4,5,6\} \text{ and } s^{\mathtt{a}}t \in T\}) \\ &= \epsilon\text{-closure}(\{4\}) \\ &= \{4\} \\ &= s'_3 \end{aligned} \tag{9}$$

$$\begin{aligned} move(s'_4, \mathtt{b}) &= \epsilon\text{-closure}(\{t | s \in \{3,4,5,6\} \text{ and } s^{\mathtt{b}}t \in T\}) \\ &= \epsilon\text{-closure}(\{3,5\}) \\ &= \{3,4,5,6\} \\ &= s'_4 \end{aligned} \tag{10}$$

state	epsilon-closure	complete
0	{1,2,4}	✓
1	{3,4,6}	✓
2	{4,5,6}	✓
3	{4}	✓
4	{3,4,5,6}	✓