编译原理 23~24 卷复

一、 TTTFF FTTTF TTFFT FFTFT

二、 BDDCA DACCD DCCBD BBDCB

三、 1. nat = [0-9]+

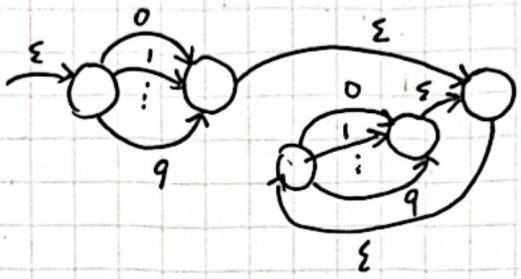
signedNat = ("+"|"-") ? nat

number = signedNat ("." nat)? (E signedNat)?

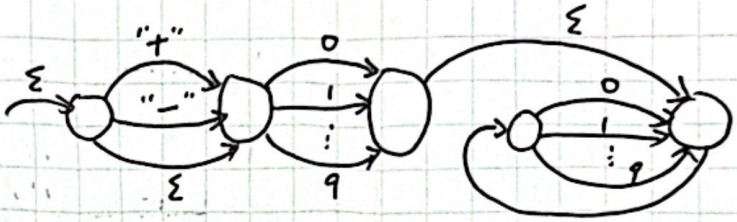
DFA for number:

The NFA:

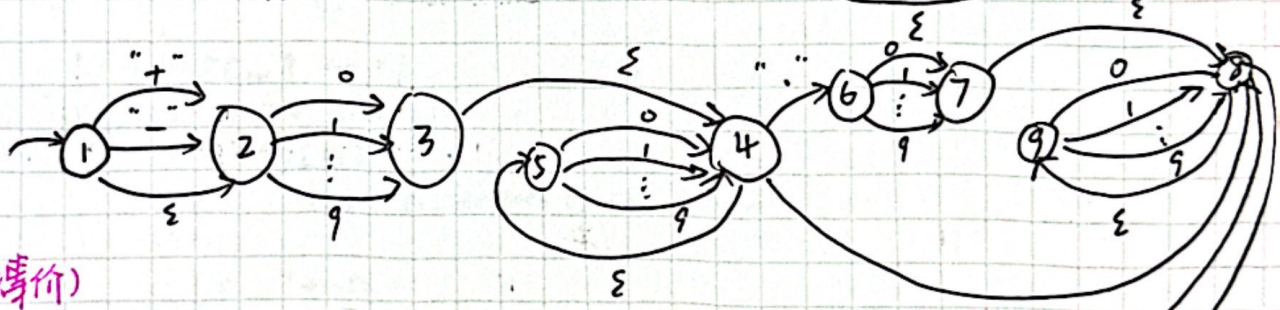
nat:



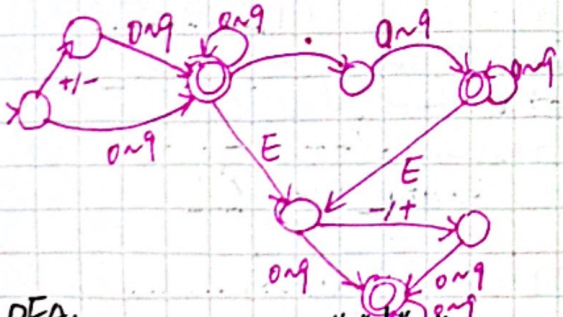
signedNat:



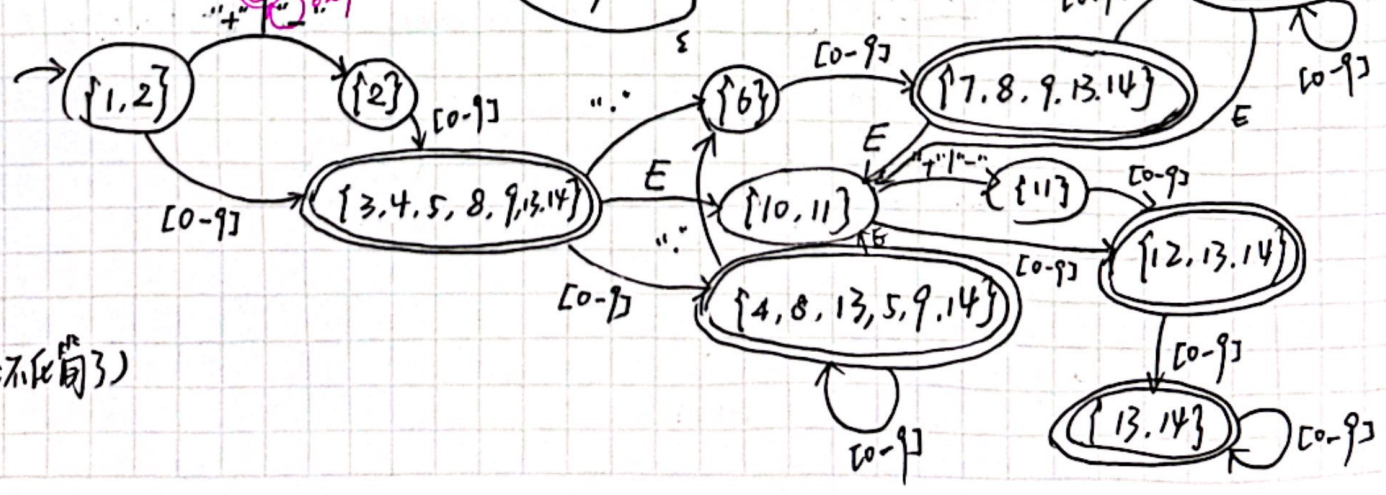
number:



附:简化后(应该等价)



DFA:



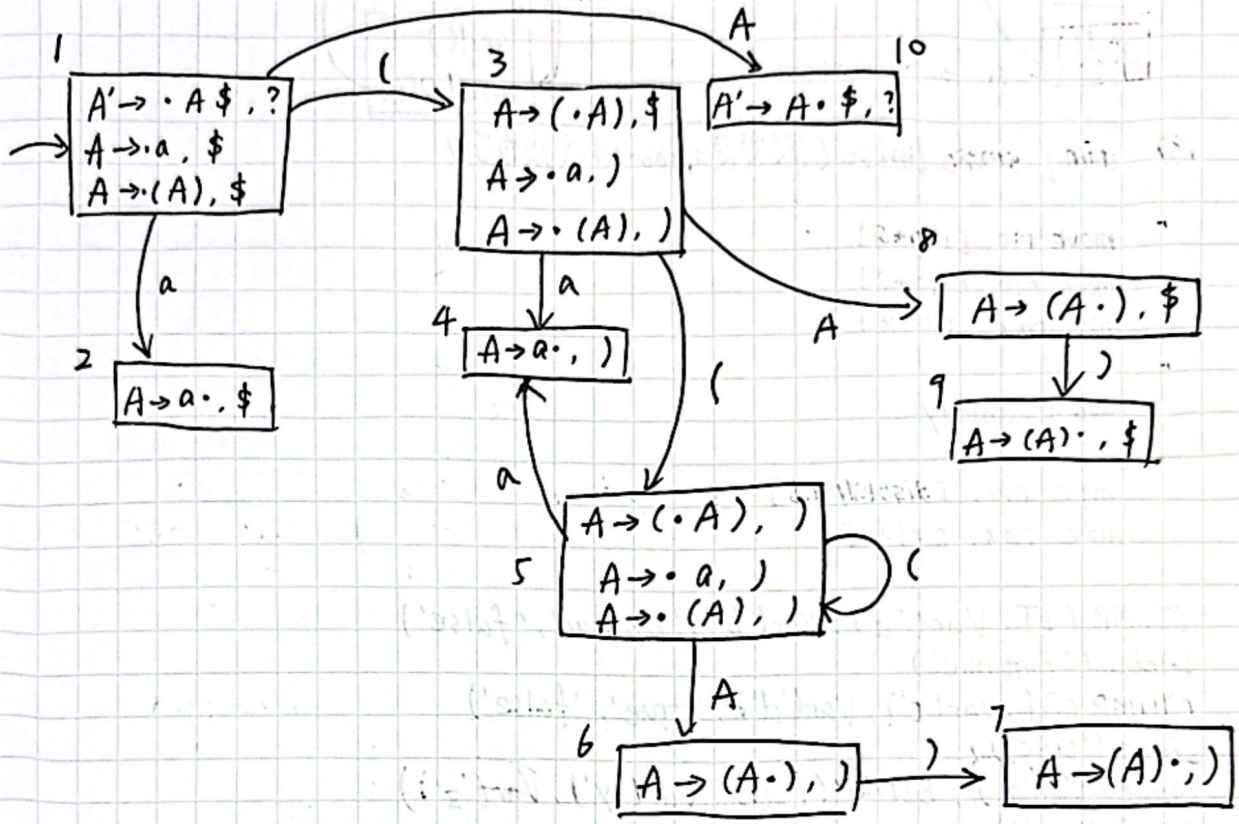
(就不化简了)

2. (1). nullable: $\emptyset$
terminal: {$, (,), a}

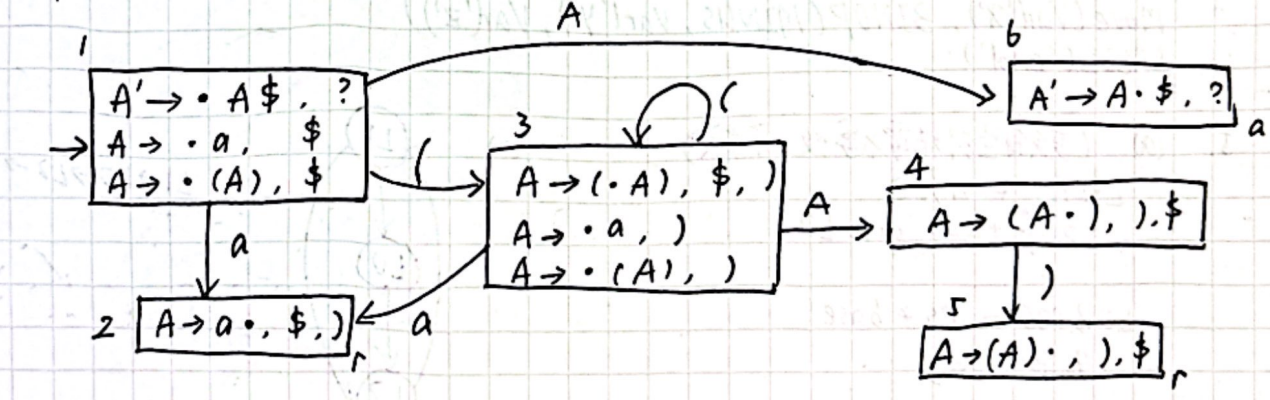
First(A) = {(, a}, First(A') = {(, a}

Follow(A) = {), $}, Follow(A') = $\emptyset$

0: A' → A$
1: A → (A)
2: A → a



合并: 3和5、2和4、6和8、7和9

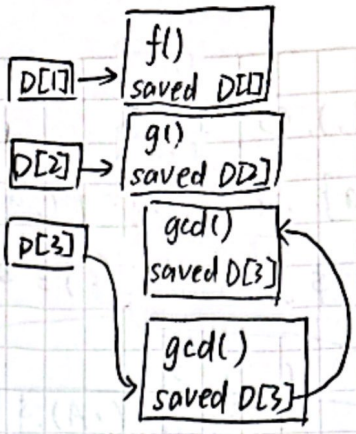


(2).

state	Action a	(	)	$	Goto A
1	s2	s3			g6
2			r2	r2	
3	s2	s3			g4
4			s5		
5			r1	r1	
6				Accept	

3. (1).

(2)



(3). using static links: (假设使用x86-64栈帧布局)

```
mov r10, [rbp+8]
mov r10, [r10+8]
mov rax, [r10-8]

using display:

mov r10, [display+8]
mov rax, [r10-8]
```

4.

```
CJUMP (LT, Var('a'), Var('b'), 'continue', 'false')
LABEL ('continue')
CJUMP (GT, Var('c'), Var('d'), 'true', 'false')
LABEL ('true')
Move (Var('x'), BINOP (PLUS, Var('y'), Var('z')))
JUMP ('end')
LABEL ('false')
Move (Var('x'), BINOP (MINUS, Var('y'), Var('z')))
LABEL ('end')
```

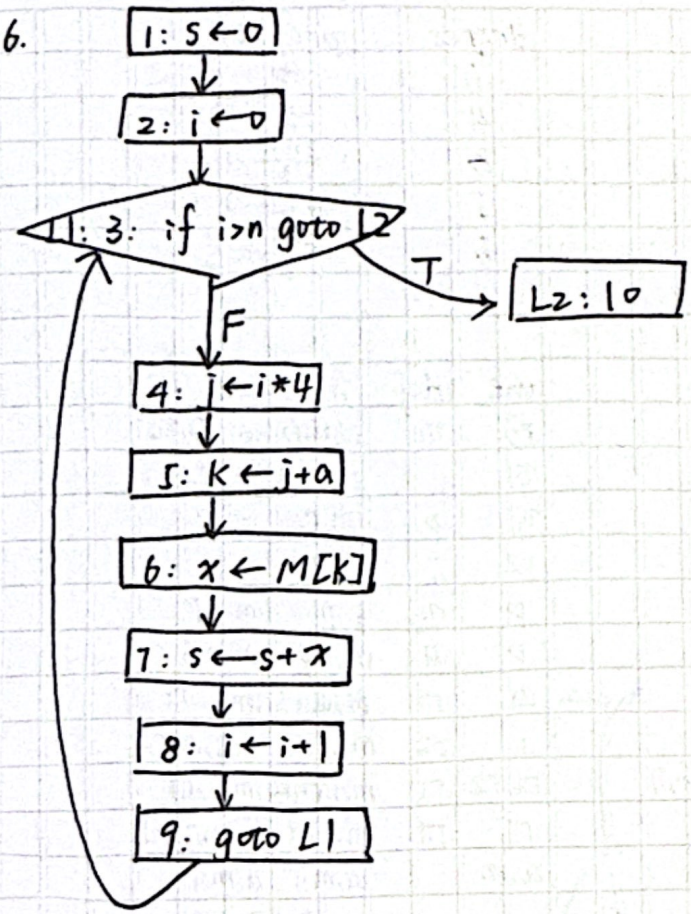
5. (1) (其实有些纠结要不要改L下标)

```
L1: 1. t ← n%2
    2. if t==0 goto L2

L0: 3. res ← res * base
       goto L2

L2: 4. base ← base * base
    5. n ← n/2
    6. if n>0 goto L1

L3. 7. return res
```

(2)

L1→L0→L2→L3

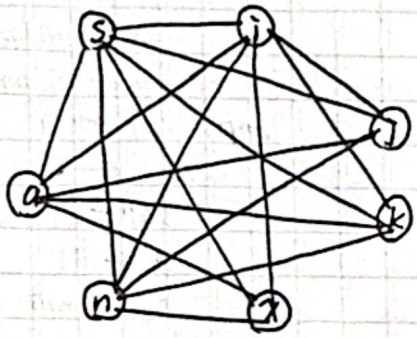
6.



(1)

inst	use	def	in	out
1		s	a,n	a,n,s
2		i	a,n,s	i,a,n,s
3	i,n		i,a,n,s	i,a,s,n
4	i	j	i,a,s,n	j,a,s,i,n
5	j,a	k	j,a,s,i,n	k,s,i,a,n
6	k	x	k,s,i,a,n	s,x,i,a,n
7	s,x	s	s,x,i,a,n	i,a,n,s
8	i	i	i,a,n,s	i,a,n,s
9			i,a,n,s	i,a,n,s
10				

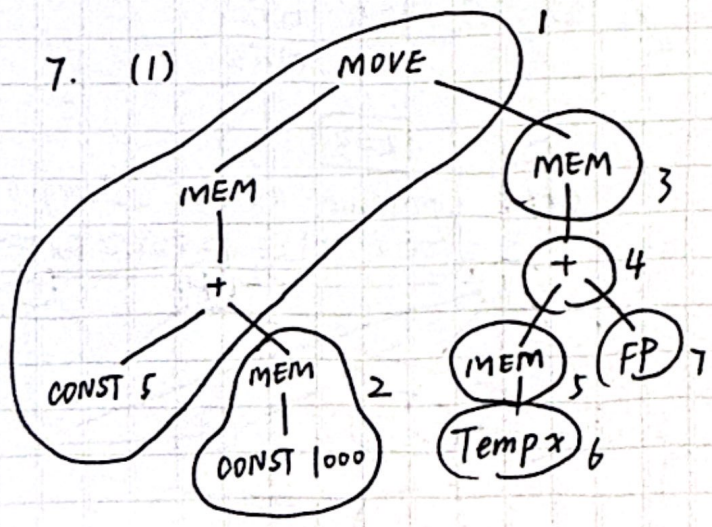
(2)



(如果按书本算法)

(如果按"同时活跃时间可能冲突")
除k和j、k和x、x和j外均冲突

7. (1)



(2)
2: LOAD r1 ← M[1000]
5: LOAD r2 ← M[r1]
4: ADD r3 ← r2+fp
3: LOAD r4 ← M[r3]
1: STORE M[5+r1] ← r4

8. (1). (a)

variable	use	def
t	1	1
p	2	1
a	3n	1+2n
i	1+3n	1+n
m	2n	1

degree	priority
6	$\frac{1}{3}$
4	$\frac{3}{4}$
3	$\frac{5n+1}{3} \geq 2$
5	$\frac{4n+2}{5} \geq \frac{6}{5}$
6	$\frac{2n+1}{6} \geq \frac{1}{2}$

∴ choose t to spill

(b).

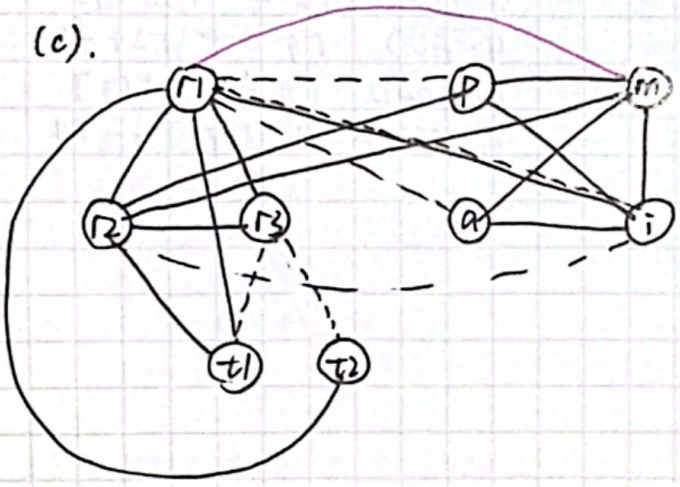
```
enter:  t1 ← r3
        M[tloc] ← t1
        p ← r1
        i ← r2
        m ← M[p]
        a ← M[p+4]
loop:   r1 ← a
        r2 ← i
        call f (use r1, r2, def r1)
        a ← r1
        if a > m goto end
        a ← m - a
        i ← i - 1
        if i > 0 goto loop
end:    r1 ← i
        t2 ← M[tloc]
        r3 ← t2
        return (r1, r3 live out)
```

succ

succ

use	def	in	out
r3	t1	r1,r2,r3	r1,r2,t1
t1		r1,r2,t1	r1,r2
r1	p	r1,r2	r2,p
r2	i	r2,p	i,p
p	m	i,p	m,i,p
p	a	m,i,p	m,a,i
a	r1	m,a,i	m,i,r1
i	r2	m,i,r1	m,i,r1,r2
r1,r2	r1	m,i,r1,r2	m,i,r1
r1	a	m,i,r1	a,m,i,r1
a,m		a,m,i	a,m,i
a,m	a	a,m,i	i,m,a
i	i	i,m,a	i,m,a
i		i,m,a	i,m,a
i	r1	i	r1
	t2	r1	t2,r1
t2	r3	t2,r1	r1,r3
		r1,r3	r1,r3

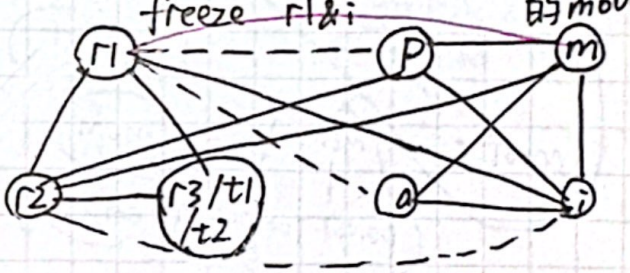
(c).



(2). $\boxed{k=3}$ r3 & t2 (George)

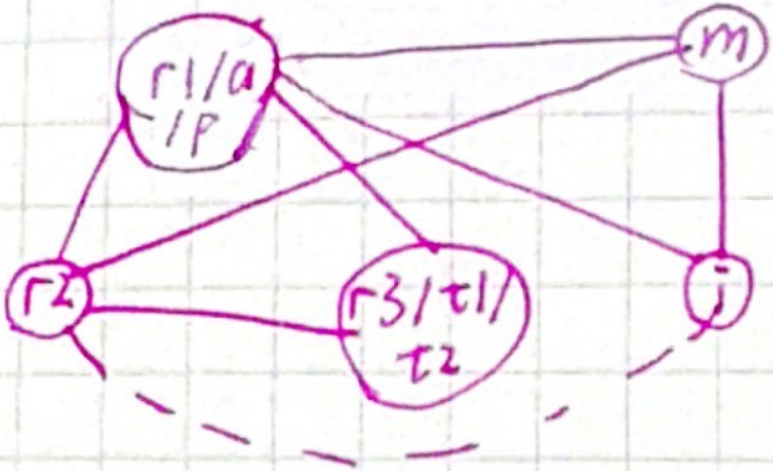
step1. Coalesce r3 & t1 (George)

freeze r1 & i 的 move



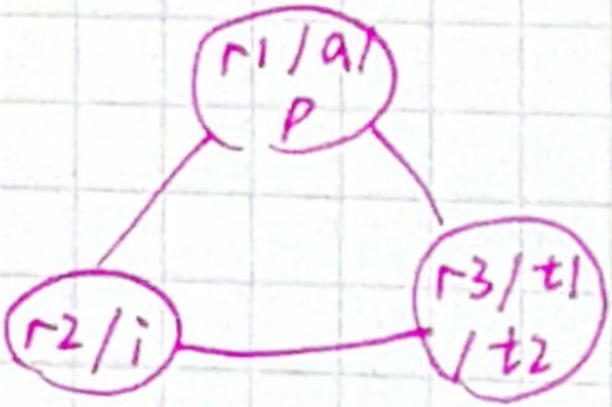
r1&p.

step2. 合并 r1&a (George)



step3. 合并 r2/i: (George)

simplify m.



color:

p	r1
i	r2
t1	r3
t2	r3
m	r3
a	r1

(3).

```
enter:  M[tloc] ← r3
        r3 ← M[r1]
        r1 ← M[r1+4]
loop:   call f  (use r1,r2 , def r1)
        if  r1 > r3 goto end
        r1 ← r3 - r1
        r2 ← r2 - 1
        if r2 > 0  goto loop
end:    r1 ← r2
        r3 ← M[tloc]
        return  (r1, r3 live out)
```

一、 **Mark each statement *true* or *false* (1 points each, 20 cents)**

T 1. When using the subset construction method, in the worst case, an n-state NFA will be converted into a 2^n-state DFA.

T 2. The regular expression `"/*" "/"* ([^*/]|[^*]"/"|"*"[^/])* "*"* "*/"` can accept all C-style comments. 没看懂

T 3. The grammar S → (S)S|ε is LL(1) (Nullable: S Follow of S:) First of S: (( ) $ S S→ε

F 4. Imperative-style environments is usually not considered to be implemented using hash tables.

F T 5. A static link of a function' s stack frame points to the its caller' s stack frame. 词法父函数

F 6. Escaping variables must be kept in the registers.

T 7. A display is an array for maintaining frame pointers.

T 8. Lexical analysis, syntax analysis, and semantic analysis are tasks that should be completed by the frontend of a compiler.

F 9. The task of instruction selection is to tile the IR tree with a minimal set of tree patterns. cost.

题意不清? F 10. Using Maximal Munch algorithm, the optimum tiling can be obtained.

T 11. The liveness of variables should be analyzed from future to past. 感觉都可以? 原理上是对的 但算法上没有"必要" 只是收敛快慢

T 12. The solution to the dataflow equation is a conservative approximation.

F 13. Via tree canonicalization, one can eliminate all the CALL instructions in the IR tree. 改成ESEQ对吗?

F 14. A node ***d*** dominates a node ***n*** if some path of directed edges from start node s_0 to ***n*** goes through ***d***. X

commute 定义 T F 15. MOVE(MEM(x), y) commutes with MEM(z) if x != z . 没看懂 可交换? 有影响

T F 16. The general rewriting rule rewrites [e1, e2, ESEQ(s, e3)] into (SEQ(MOVE(t1, e1), s); [TEMP(t1), e2, e3]) if s commutes with e1, yet not with e2 .

F 17. For graph coloring with coalescing, if neither simplify nor coalesce applies, we should first select a node for potential spilling.

T 18. In an interference graph, if there is a MOVE between a and b, and for every neighbor t of b, either t already interferes with a or t is of insignificant degree, then a and b can be coalesced.

F T 19. The records whose reference counts are not zero will not be reclaimed by the mark-and-sweep collection. 方法不匹配

T 20. Using breadth-first copying collection instead of depth-first copying can