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```
22
23      #  Think: why might we want to flag whether we are at the first clause?
24      if (firstMatch == 1) {firstMatch = 0} else {printf(" & ");}
25
26         #  Think: what should we print if a vertex has no incoming edges?
27         if (NF == 2)
28         {
29                 printf("(v%d)", $2);
30         }
31         else
32         {
33                 #  this loop ensures the first condition of kernels is met
34                 printf("(v%d", $NF);
35                 for (i = 1 ; i <= NF-2 ; i++)
36                 {
37                         printf(" | v%d", $i);
38                 }
39                 printf(")");
40
41                 # this loop ensures the second condition of kernels is met
42                 for (i = 1 ; i <= NF-2 ; i++)
43                 {
44                          printf(" & (~v%d | ~v%d)", $i, $NF);
45                 }
46         }
47   }
48
49
50  END  {
51    printf("\n");
52  }
```

Set vertices: n

arcs: m

the number of arcs to vertices i is d_i

a line break at the end: 1

&(∧) each vertex before first clause: $n-1$

independent clause: $\sum d_i = m$

non-independent clause: $\sum (d_i + 2) = m + 2n$

total: $(m+2n)+m+n-1+1$

$= 2m+3n$

in digraph $m = n(n-1)$

$2n(n-1)+3n$

$= 2n^2-2n+3n$

$= 2n^2+n$

(a) $2n^2+n$

(b) $O(n^2)$