Problem 3

Tuesday, 13 August 2024

(a) Give, with brief justification, an expression for the number of cla
m (the number of edges of G) and t (the number of triangles in
number of clauses produced by your `awk` program (`prob2.awk`) mu
equalling the expression you give here.

In the algorithm implemented in the awk file, it first creates a clause (vi|vk) for each lin
line which tells our program how many lines there are). Therefore during this, it genera
edge). Once it finishes looping through all the lines, it goes through an algorithm that f
in the text file and for each triangle found, generates a clause (~vi, ~vj, ~vk) to emit the
each triangle.

In total the number of clauses generated will be m + t.
The output for the awk function in prob2 aligns with this rule:
(v1|v2) & (v1|v3) & (v1|v4) & (v2|v3) & (v2|v6) & (v3|v5) & (v4|v7) & (v5|v7) & (v6|v
This contains 10 clauses, 9 edges + 1 triangle.

(b) Give, with brief justification, an expression for an upper bound on the number of tri
t in G in terms of m. (You don't need to find the tightest bound possible, but it ne
be tight enough to support your argument in part (c).)

The number of triangles cannot exceed the number of edges on the tree. Since 3 edges are
form a triangle, we cannot form n count of triangles with n edges.

t<m

(c) Based on your answers to (a) and (b), give with brief justification an upper b
number of clauses of φ_G, expressed *only* in terms of m.

Question A we determined that total clauses = m + t
Question B we determined that bound for t is m
Therefore total causes < 2*m

auses of φ_G in terms of
G). For full marks, the
ust be correct as well as

ne which represents 1 edge (ignoring the first
ates m number of edges (1 clause for each
finds all sets of 3 edges that share 3 vertices
e triangle. Therefore it generates 1 clause for

v7) & (~v1|~v2|~v3)

angles
eeds to

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