MIDTERM (MATH 180, SPRING 2016)

Your Name: ______________________________________

UCLA id: ______________________________________

Date: ________________________________

The rules:
You are allowed to use only this paper and pen/pencil. No calculators.
No books, no notebooks, no scratch paper, no web access. You MUST write your name.
You MUST simplify completely and BOX all answers. Except for the last problem,
you MUST write out your logical reasoning and/or proof in full. Your name,
the id number and boxed answers MUST be in ink. You have exactly 50 minutes.

Points:

1	
2	
3	
4	
5	

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Total: **(out of 100)**

Problem 1. (20 points, 4 points each part)
In each case, compute the number of subgraphs of G isomorphic to H:

a) $G = K_9\,,\quad H = P_3$

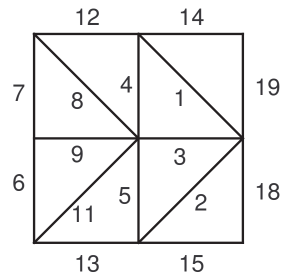
b) $G = K_9\,,\quad H = P_9$

c) $G = K_{8,8}\,,\quad H = P_3$

d) $G = C_{10}\,,\quad H = P_5$

e) $G = K_{8,9}\,,\quad H = C_5$

Problem 2. (15 points)
Find the minimal spanning tree in the following graph. Compute its weight.



Problem 3. (15 points)

Let D be *dodecahedron graph* discussed in class. The *icosahedron graph* is its dual: $G = D^*$. Find the score of $G = (V, E)$. Compute $|V|$, $|E|$ and $|F|$. Check Euler's formula for G.

Problem 4. (20 points)
Suppose graphs G_1 and G_2 have the same score $(6, 6, 6, 6, 6, 6, 6, 6)$. Prove that G_1 and G_2 are isomorphic.

Problem 5. (30 points, 3 points each). **True or False?**
Circle the answers. Must circle in ink. No reasoning/calculations will be taken into account.

T **F** (a) Graph $K_{5,5}$ is isomorphic to a subgraph of $K_{7,4}$.

T **F** (b) If $G = (V, E)$ is planar and $|V| = 10$, then $|E| \leq 25$.

T **F** (c) If $G = (V, E)$ has no C_3 and $|V| = 10$, then $|E| \leq 25$.

T **F** (d) If G has score $(4, 4, 4, 4, 4, 4, 4, 4)$, then G has an Eulerian circuit.

T **F** (e) If G has score $(5, 5, 5, 5, 5, 5, 5, 5)$, then G has an Eulerian circuit.

T **F** (f) If G has score $(7, 7, 7, 7, 7, 7, 7, 7)$, then G has a Hamiltonian cycle.

T **F** (g) If G has a bridge $e \in E$, then it cannot have a Hamiltonian cycle.

T **F** (h) The Six Color Theorem implies the Five Color Theorem.

T **F** (i) If G has no C_3's, then G is bipartite.

T **F** (j) Every two triangulations on 6 vertices are isomorphic.