Problem Session #7

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CSE 211 - Gebze Technical University

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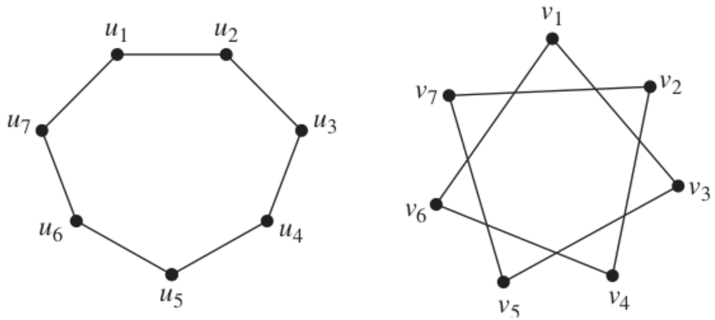
Overview

Problem 1:Graph Isomorphism

Determine whether each pair of graphs is isomorphic or not.



These graphs are isomorphic since each is the 7-cycle.

Problem 1:Graph Isomorphism

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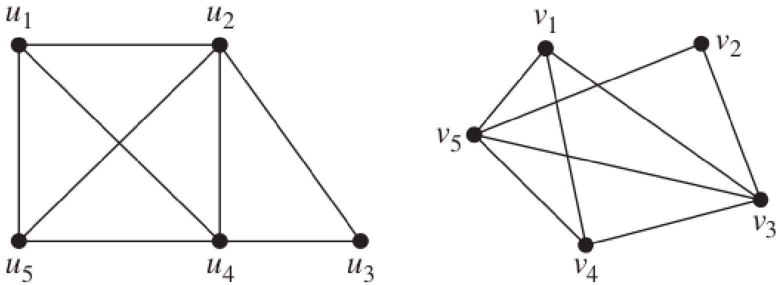

One isomorphism is f(u_3)=v_2, f(u_4)=v_3, f(u_2)=v_5, f(u_1)=v_1, f(u_5)=v_4.

Problem 1:Graph Isomorphism

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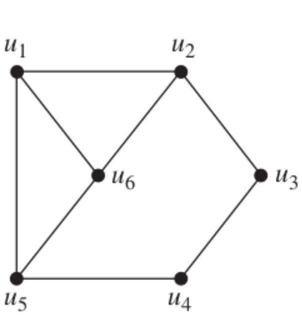
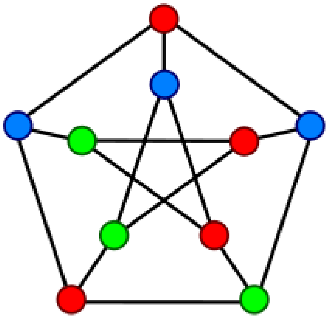


They are not isomorphic.

Problem 2: Graph Coloring Problem

Definition

Graph coloring is a way of coloring the vertices of a graph such that no two adjacent vertices are of the same color. The objective of graph coloring problem is using the minimum number of different colors considering the rule.



Problem 2: Graph Coloring Problem in Register Allocation

Consider the program
a := c + d
e := a + b
f := e - 1
with the assumption that a and e die after use

Temporary "a" can be "reused" after e := a + b.
Same with temporary "e".

Can allocate a, e, and f all to one register (r1):
$r_1 := r_2 + r_3$
$r_1 := r_1 + r_4$
$r_1 := r_1 - 1$

Problem 2: Graph Coloring Problem in Register Allocation

Rule

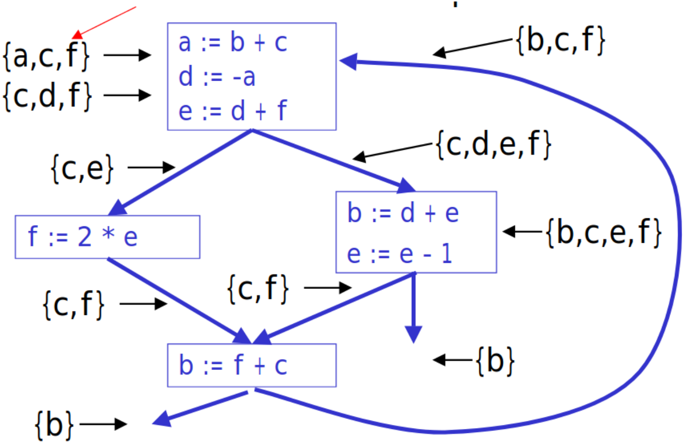
Temporaries t_1 and t_2 can share the same register if at any point in the program at most one of t_1 or t_2 is live.

```
a := b + c
d := -a
e := d + f
if something do
        f := 2 * e
else do
        b := d + e
        e := e - 1
end
b := f + c
```

Problem 2: Graph Coloring Problem in Register Allocation

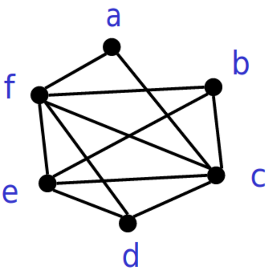
Rule

Temporaries t_1 and t_2 can share the same register if at any point in the program at most one of t_1 or t_2 is live.

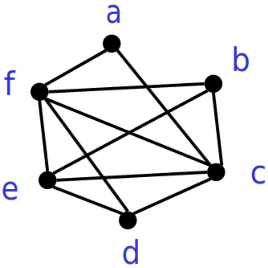


Problem 2: Graph Coloring Problem in Register Allocation

- Two temporaries that are live simultaneously cannot be allocated in the same register.
- We construct an undirected graph:
  - A node for each temporary variable.
  - An edge between t_1 and t_2 if they are live simultaneously at some point in the program.
- This is the register interference graph (RIG): Two temporaries (vertices) can be allocated (colored) to the same register (color) if there is no edge connecting them.



Problem 2: Graph Coloring Problem in Register Allocation



Color 1 (Register 1): a, b, d
Color 2 (Register 2): c
Color 3 (Register 3): e
Color 4 (Register 4): f