

Register Allocation

Graph Colouring

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- ▶ A graph is k -colourable if it can be coloured with $\leq k$ colours.

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- ▶ **Colouring:** Assignment of colours to nodes such that no two neighbours have the same colour.
- ▶ A graph is k -colourable if it can be coloured with $\leq k$ colours.
- ▶ Graph colouring is NP-complete.
- ▶ Heuristic

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Graph Colouring

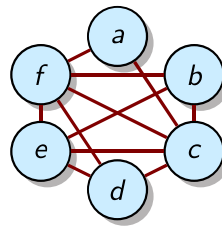
Heuristic

- ▶ Select any node with $< k$ neighbours. Remove the node and all its edges.
- ▶ Push into stack.
- ▶ Repeat until all nodes pushed into the stack.
- ▶ Start popping nodes from stack.
- ▶ Assign colours as necessary.

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Graph Colouring – Heuristic

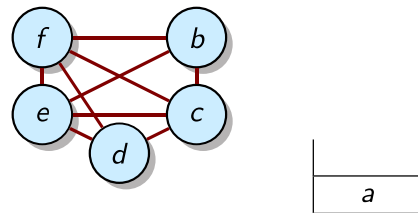
Example



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Graph Colouring – Heuristic

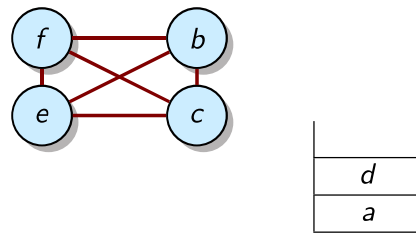
Example



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Graph Colouring – Heuristic

Example



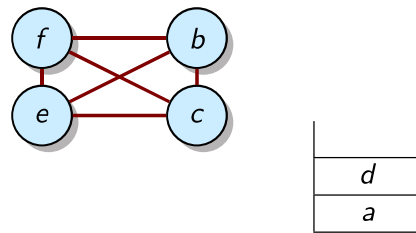
Observations:

1. Now, all nodes have $< k$ neighbours

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Graph Colouring – Heuristic

Example



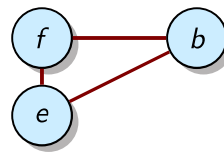
Observations:

1. Now, all nodes have $< k$ neighbours \rightarrow the graph colouring will succeed.
2. Some nodes with originally $\geq k$ neighbours now have $< k$ nodes.

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Graph Colouring – Heuristic

Example

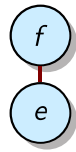


<i>c</i>
<i>d</i>
<i>a</i>

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Graph Colouring – Heuristic

Example



b
c
d
a

Register Allocation

Graph Colouring – Heuristic

Example



e
b
c
d
a

Register Allocation

Graph Colouring – Heuristic

Example

f
e
b
c
d
a

Register Allocation

Graph Colouring – Heuristic

Example

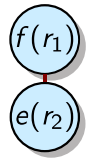


e
b
c
d
a

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Graph Colouring – Heuristic

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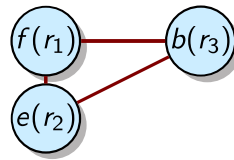


b
c
d
a

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Graph Colouring – Heuristic

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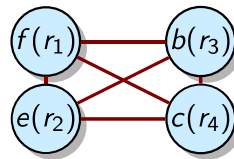


c
d
a

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Graph Colouring – Heuristic

Example

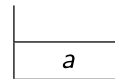
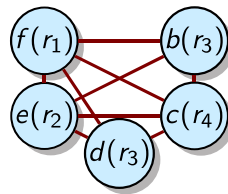


d
a

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