CS738: Advanced Compiler Optimizations

SSAPRE: Example

Amey Karkare
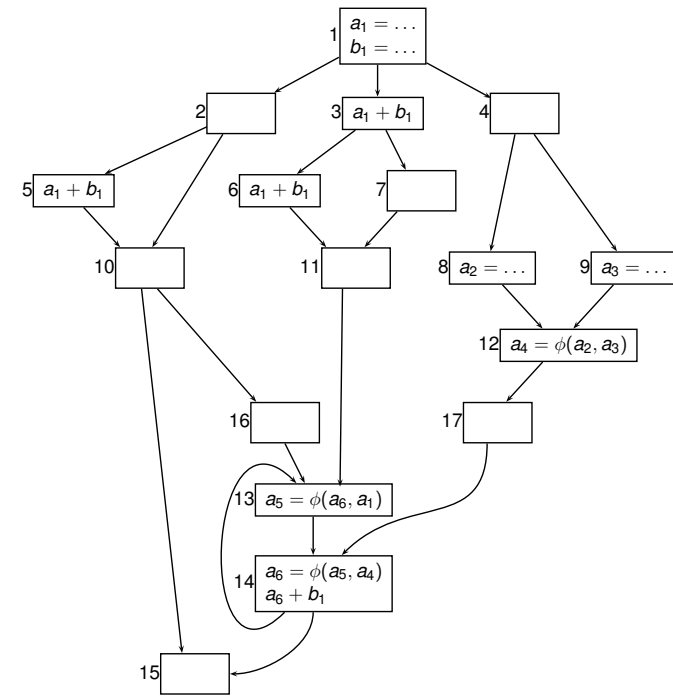
karkare@cse.iitk.ac.in
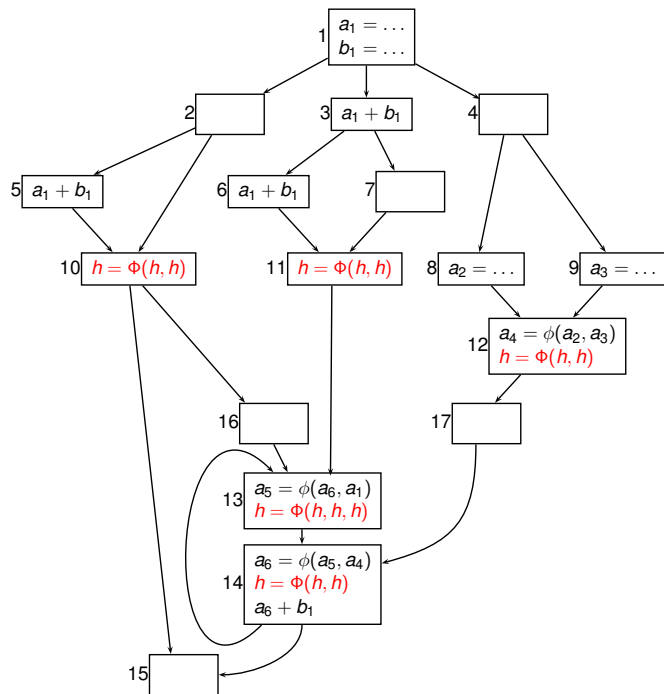
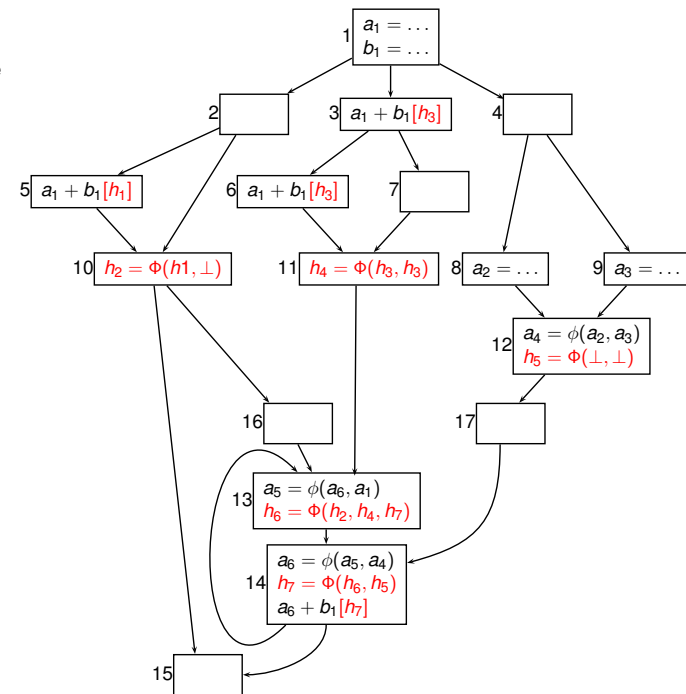http://www.cse.iitk.ac.in/~karkare/cs738
Department of CSE, IIT Kanpur

Example

Φ insertion

Rename

FRG (def-use) edges
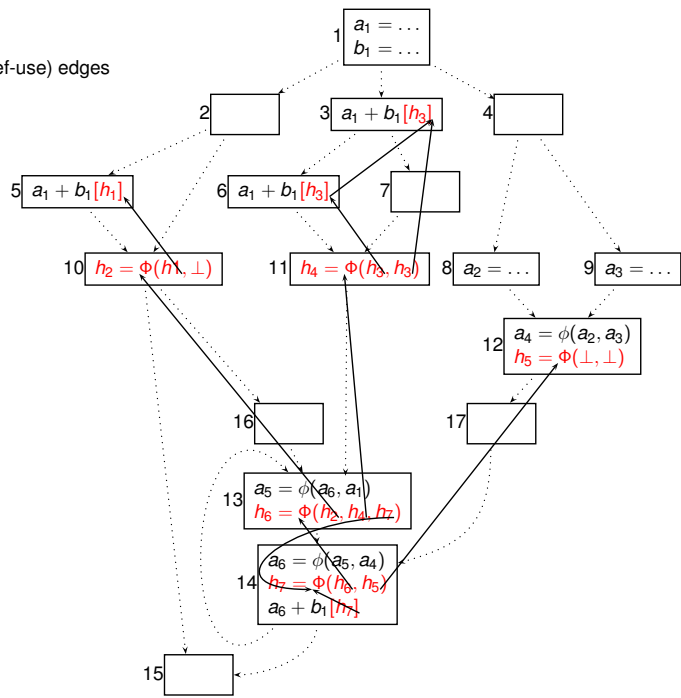
Block 1: $a_1 = \dots$, $b_1 = \dots$
Block 3: $a_1 + b_1 [h_3]$
Block 5: $a_1 + b_1 [h_1]$
Block 6: $a_1 + b_1 [h_3]$
Block 10: $h_2 = \Phi(h_1, \bot)$
Block 11: $h_4 = \Phi(h_3, h_3)$
Block 8: $a_2 = \dots$
Block 9: $a_3 = \dots$
Block 12: $a_4 = \phi(a_2, a_3)$, $h_5 = \Phi(\bot, \bot)$
Block 13: $a_5 = \phi(a_6, a_1)$, $h_6 = \Phi(h_2, h_4, h_7)$
Block 14: $a_6 = \phi(a_5, a_4)$, $h_7 = \Phi(h_6, h_5)$, $a_6 + b_1 [h_7]$

Down-safety

Φ Block	Value
10	false
11	true
12	true
13	true
14	true
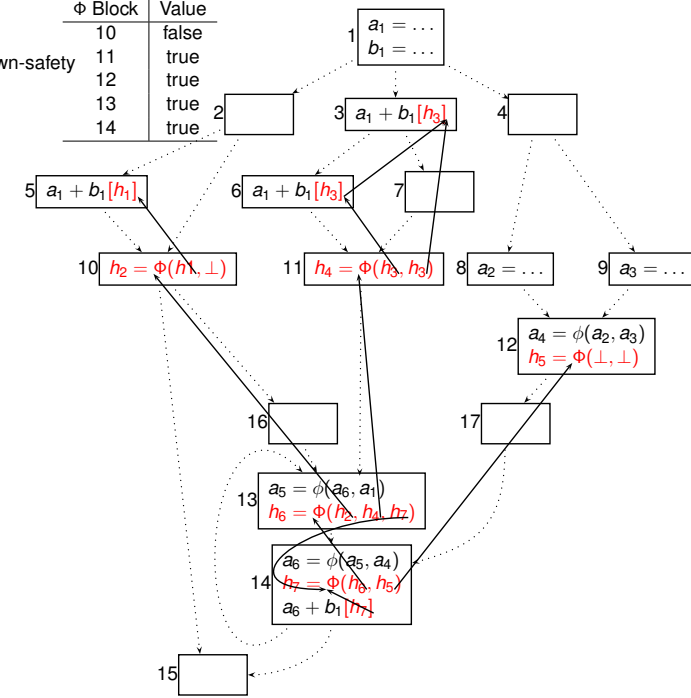
CanBeAvail

Φ Block	Value
10	false
11	true
12	true
13	true
14	true
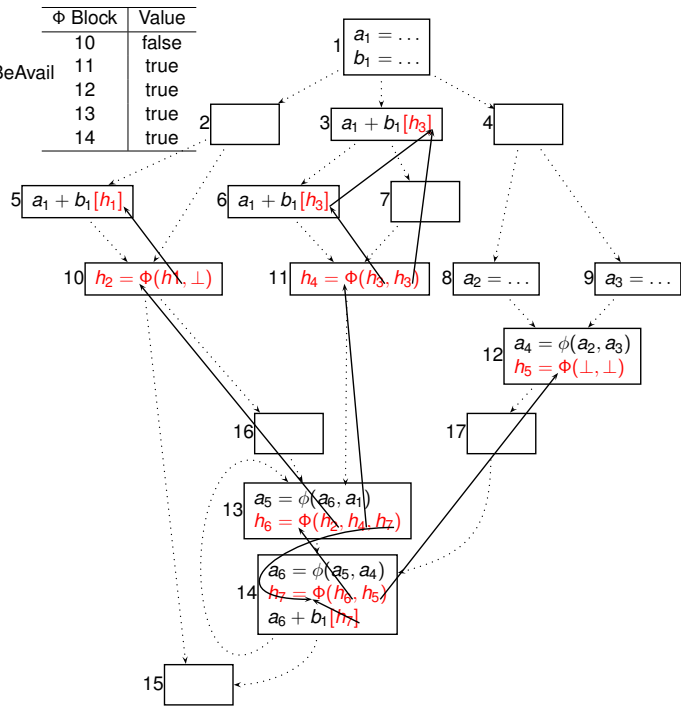
Later

Φ Block	Value
10	-
11	false
12	true
13	false
14	false

WillBeAvail

Φ Block	Value
10	false
11	true
12	false
13	true
14	true

1 $a_1 = \ldots$ $b_1 = \ldots$

2

3 $a_1 + b_1\,[h_3]$

4

5 $a_1 + b_1\,[h_1]$

6 $a_1 + b_1\,[h_3]$

7

10 $h_2 = \Phi(h_1, \bot)$

11 $h_4 = \Phi(h_3, h_3)$

8 $a_2 = \ldots$

9 $a_3 = \ldots$

12 $a_4 = \phi(a_2, a_3)$ $h_5 = \Phi(\bot, \bot)$

16

17

13 $a_5 = \phi(a_6, a_1)$ $h_6 = \Phi(h_2, h_4, h_7)$

14 $a_6 = \phi(a_5, a_4)$ $h_7 = \Phi(h_6, h_5)$ $a_6 + b_1\,[h_7]$

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Finalize

Φ Block	Reload,Save
3	f,t
5	f,t
6	t,f
14	t,f

1 $a_1 = \ldots$ $b_1 = \ldots$

2

3 $a_1 + b_1\,[h_3]$

4

5 $a_1 + b_1\,[h_1]$

6 $a_1 + b_1\,[h_3]$

7

10 $h_2 = \Phi(h_1, \bot)$

11 $h_4 = \Phi(h_3, h_3)$

8 $a_2 = \ldots$

9 $a_3 = \ldots$

12 $a_4 = \phi(a_2, a_3)$ $h_5 = \Phi(\bot, \bot)$

16

17

13 $a_5 = \phi(a_6, a_1)$ $h_6 = \Phi(h_2, h_4, h_7)$

14 $a_6 = \phi(a_5, a_4)$ $h_7 = \Phi(h_6, h_5)$ $a_6 + b_1\,[h_7]$

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Finalize

Φ Block	Insert
16	t
17	t
Others	f

1 $a_1 = \ldots$ $b_1 = \ldots$

2

3 $a_1 + b_1\,[h_3]$

4

5 $a_1 + b_1\,[h_1]$

6 $a_1 + b_1\,[h_3]$

7

10 $h_2 = \Phi(h_1, \bot)$

11 $h_4 = \Phi(h_3, h_3)$

8 $a_2 = \ldots$

9 $a_3 = \ldots$

12 $a_4 = \phi(a_2, a_3)$ $h_5 = \Phi(\bot, \bot)$

16

17

13 $a_5 = \phi(a_6, a_1)$ $h_6 = \Phi(h_2, h_4, h_7)$

14 $a_6 = \phi(a_5, a_4)$ $h_7 = \Phi(h_6, h_5)$ $a_6 + b_1\,[h_7]$

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Code Motion

1 $a_1 = \ldots$ $b_1 = \ldots$

2

3 $t_3 = a_1 + b_1$

4

5 $t_1 = a_1 + b_1$

6 t_3

7

10

11

8 $a_2 = \ldots$

9 $a_3 = \ldots$

12 $a_4 = \phi(a_2, a_3)$

16 $t_2 = a_1 + b_1$

17 $t_5 = a_4 + b_1$

13 $a_5 = \phi(a_6, a_1)$ $t_6 = \phi(t_2, t_3, t_7)$

14 $a_6 = \phi(a_5, a_4)$ $t_7 = \phi(t_6, t_5)$ t_7

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