Compilation Methods SS 2013 - Assignment 2

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Exercise 1 (Control-Flow Graph)

```
0:   iconst_1
1:   istore_1
2:   iconst_1
3:   istore_2
4:   iload_2
5:   bipush  32
7:   if_icmpge 28
10:  iload_1
11:  sipush  10000
14:  if_icmpge 21
17:  iconst_2
18:  iload_1
19:  imul
20:  istore_1
21:  iload_2
22:  iconst_1
23:  iadd
24:  istore_2
25:  goto    4
28:  return
```

a) Construct a graphical representation of the control flow graph.
b) Compute the dominator relation and draw the idom tree.
c) Find the back edge and compute its natural loop.
d) HOMEWORK:
Reconstruct the Java source code. Embed it into the following class structure:

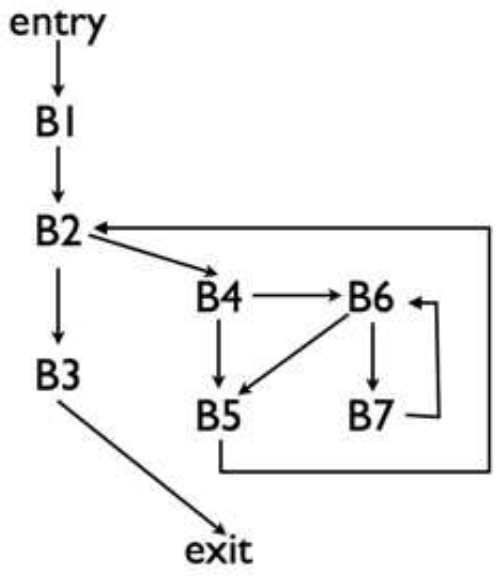
```
class WhatEver {
    public static void main(String[] args) {


    }
}
```

Compile the Java source, extract the byte code using (`javap -c`), and compare it to the byte code given above.

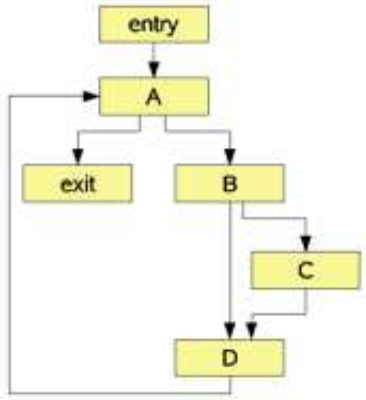
Exercise 2 (Control-Flow Graph)

a) Write a Java method that matches the following control-flow graph



b) Compute the dominator relation and draw the idom tree.
c) Compute the natural loop for each back edge.

Exercise 3 (Dominator Relation, Loop Recognition)



a) Determine the dominator relation.
b) Determine all back edges.
c) Determine all natural loops.

Exercise 4 (Loop invariant computations, induction variables)

```
i = 1;
do j = i + 1;
   do a[i, j] = 10 * n - 3 * i + j;
      j = j + 1;
   while (j < n);
   i = i + 1;
while (i < n)
```

a) Draw the control-flow graph.
b) Determine all back edges and their natural loops
c) Move all loop invariant computations to pre-headers. Do you need to insert new blocks to act as pre-headers?
d) Determine all induction variables. Simplify computations using induction variables.

Exercise 5 (Loop invariant computations, induction variables)

```
i = 1;
while (i < n) {
  a[i] = i * 3.14 / (n * 100);
  i = i + 1;
}
```

a) Draw the control-flow graph.
b) Determine all back edges and their natural loops
c) Move all loop invariant computations to pre-headers. Do you need to insert new blocks to act as pre-headers?

d)
Simplify computations using induction variables.