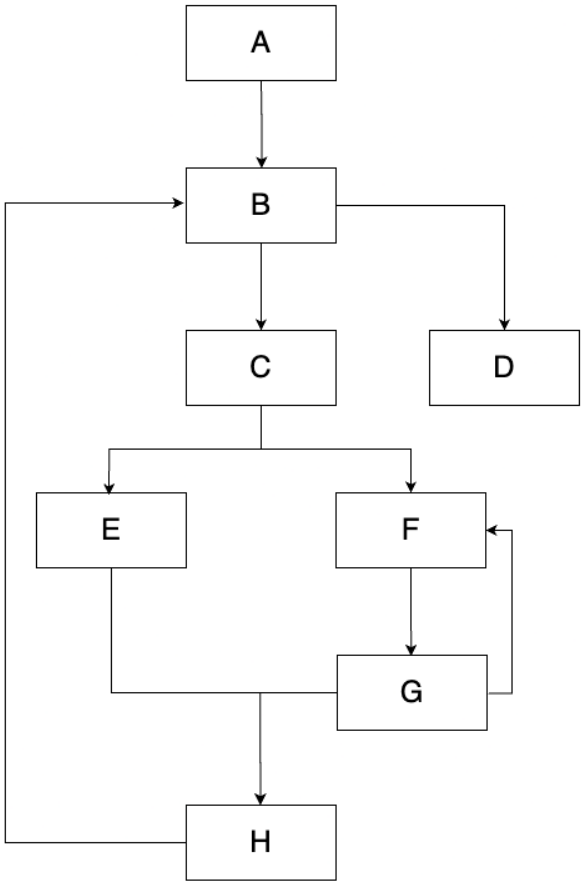
1 Dominance

In the following CFG, `A` is the entry node and `D` is the exit node.



1.1 Dominator Tree

Draw the dominator tree of the CFG.

1.2 Finding Loops

There are two loops in this CFG. Identify loop header and nodes of each loop.

Loop	Header	Nodes
1		
2		

1.3 Decaf Detective

Using just control flow keywords, write the skeleton of a function body that could produce this CFG.

2 Loop Optimizations

Consider the following Decaf snippet:

```
int a = 4;
int d = 24;
while (a < 12) {
    int b = (d + 72) / d;
    int c = 4 * a + 8;
    printf("Lick 'em %d %d\n", c, b);
    a += 2;
}
```

2.1 Which variable is the base induction variable?

2.2 Which variable(s) are derived induction variables?

2.3 Which statement(s) are loop-invariant?

2.4 Putting it All Together

Using your answers to previous parts, write an optimized Decaf snippet that produces the same results.

3 Parallelization

Consider the following loop nest:

```
for (int i = 0; i < n; i++) {
    for (int j = n - 1; j >= i; j--) {
        A[i][j] = A[i - 1][j] * 2025;
    }
}
```

3.1 Iteration Space

Assuming $n = 4$, draw the iteration space and distance vector(s) for this loop nest.

3.2 Distance Vectors

What is the distance vector for this loop nest?

3.3 Speeding it Up

Which loop(s) can run in parallel?