Summary in Graph

Exam Summary (GO Classes Test Series 2024 | Compiler Design | Test 3)

Qs. Attempted:	**11** (5 + 6)	**Correct Marks:**	**11** (5 + 6)
Correct Attempts:	**8** (5 + 3)	**Penalty Marks:**	**0** (0 + 0)
Incorrect Attempts:	**3** (0 + 3)	**Resultant Marks:**	**11** (5 + 6)

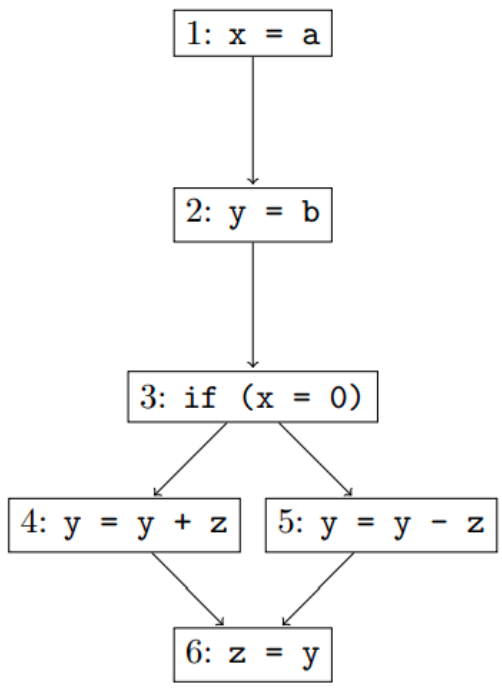
Total Questions:	**15** (5 + 10)
Total Marks:	**25** (5 + 20)
Exam Duration:	**45 Minutes**
Time Taken:	**45 Minutes**

EXAM RESPONSE | EXAM STATS | FEEDBACK

Technical

Q #1 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Compiler Design

Consider the following Control flow graph (CFG) of a program :



For the above CFG of basic blocks, Which of the following is Correct?

A. All Possible Statements have been combined to form the right number of Basic Blocks.

B. The Basic Blocks $1, 2, 3$ can be combined together.
C. The Basic Block 4 and 5 can be combined together.
D. The Basic Block 5 and 6 can be combined together.

Your Answer: B **Correct Answer: B** Correct Discuss

Q #2 Multiple Choice Type Award: 1 Penalty: 0.33 Compiler Design

Consider the following basic block, in which all variables are integers.

```
   a := b + c
   z := a * a
   x := 0
   y := b + c
5. w := y * y
   u := x + 3
   v := u + w
```

Assume that the only variables that are live at the exit of this block are v and z.
Consider the following transformation of the given basic block after applying a particular optimization.

```
   a := b + c
   z := a * a
   x := 0
   y := a
5. w := y * y
   u := x + 3
   v := u + w
```

Which of the following best describes the optimization that has been performed?

A. algebraic simplification
B. common sub-expression elimination
C. copy propagation
D. dead code elimination

Your Answer: B **Correct Answer: B** Correct Discuss

Q #3 Multiple Choice Type Award: 1 Penalty: 0.33 Compiler Design

Consider the following basic block, in which all variables are integers.

```
   a := b + c
   z := a * a
   x := 0
   y := a
5. w := a * a
   u := 3
   v := u + w
```

Assume that the only variables that are live at the exit of this block are v and z.
Consider the following transformation of the given basic block after applying a particular optimization.

```
   a := b + c
   z := a * a
   w := a * a
   u := 3
5. v := u + w
```

Which of the following best describes the optimization that has been performed?

A. algebraic simplification

B. common sub-expression elimination
C. copy propagation
D. dead code elimination

Your Answer: D **Correct Answer: D** Correct Discuss

Q #4 Multiple Select Type Award: 1 Penalty: 0 Compiler Design

Consider the following basic block :

```
   // live { ? }
   a = b + 1
   c = a - b
   d = d + c
5. e = a - c
   f = d + e
   // live {f,e}
```

At the bottom of the basic block, variables f, e are live. What will be the variables that will be live at the beginning of the basic block i.e. what belongs to Live { ? }?

A. a
B. b
C. c
D. d

Your Answer: B;D **Correct Answer: B;D** Correct Discuss

Q #5 Multiple Choice Type Award: 1 Penalty: 0.33 Compiler Design

DAG representation of a basic block allows

A. Automatic detection of local common subexpressions
B. Detection of induction variables
C. Automatic detection of loop variant
D. None of the mentioned

Your Answer: A **Correct Answer: A** Correct Discuss

Q #6 Multiple Select Type Award: 2 Penalty: 0 Compiler Design

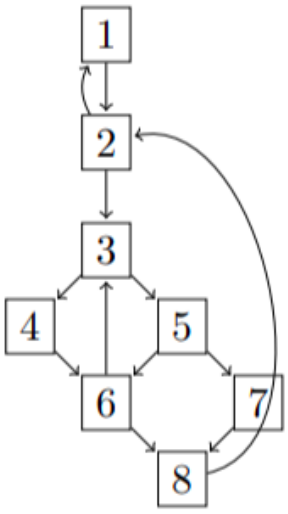
Which of the following statements regarding SSA form (Static Single Assignment form) of an intermediate representation is False?

A. If a program is in SSA form, then use of a variable is reached by exactly one definition of that variable.
B. Flow of control in SSA form remains the same as in the non-SSA form.
C. Since every variable has exactly one definition in the program text, so there are no loops in SSA form
D. Some compiler optimizations perform better on SSA forms.

Your Answer: **Correct Answer: C** Not Attempted Discuss

Q #7 Multiple Choice Type Award: 2 Penalty: 0.67 Compiler Design

A node p in a control flow graph(CFG) dominates a node q if every path from the entry node to q goes through p. We say that node p is a dominator of node q.
The dominator set of node q, $\mathrm{DOM}(q)$, is formed by all nodes that dominate q. By definition, each node dominates itself, therefore, $q\ \mathrm{DOM}(q)$.
Consider the following control flow graph(CFG) of a program P in low level intermediate representation, which has 8 basic blocks(nodes) :



Which of the following is $\mathrm{Dom}(8)$?

A. $\{1,2,3,4,5,6,7,8\}$
B. $\{1,2,3,6,7,8\}$
C. $\{1,2,3,8\}$
D. $\{6,7,8\}$

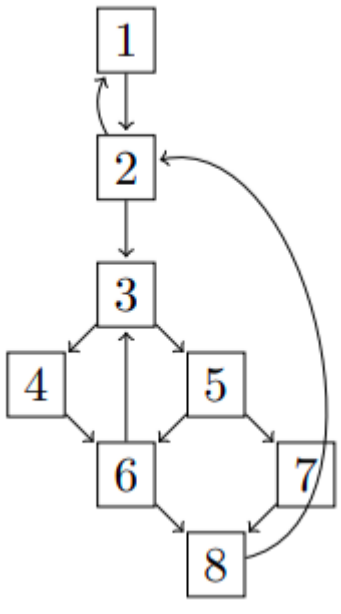
Your Answer: **Correct Answer: C** Not Attempted Discuss

Q #8 Numerical Type Award: 2 Penalty: 0 Compiler Design

A node p in a control flow graph(CFG) N dominates a node q if every path from the entry node to q goes through p. We say that node p is a dominator of node q.
The dominator set of node q, $\mathrm{DOM}(q)$, is formed by all nodes that dominate q. By definition, each node dominates itself, therefore, $\mathrm{q} \in \mathrm{DOM(q)}$

- p dominates q, written $\mathrm{p} \leq \mathrm{q}$, i.e. $\mathrm{p} \in \mathrm{DOM(q)}$.
- p properly (strictly) dominates q, written $\mathrm{p} < \mathrm{q}$ if $\mathrm{p} \leq \mathrm{q}$ and $\mathrm{p} \neq \mathrm{q}$.
- p immediately (or directly) dominates q, if $\mathrm{p} < \mathrm{q}$ and there is no node t such that $\mathrm{p} < \mathrm{t} < \mathrm{q}$.

We say p is the immediate dominator of q and write $p = \mathrm{IDOM}(q)$
Consider the following control flow graph(CFG) of a program P in low level intermediate representation, which has 8 basic blocks(nodes) :

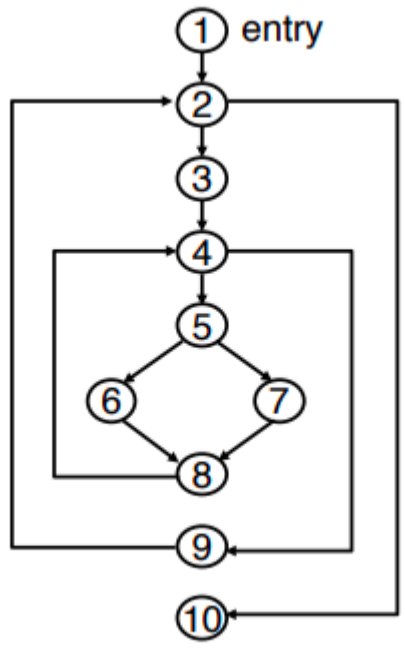


Which node is the immediate dominator of node 8?

Your Answer: | Correct Answer: 3 | Not Attempted | Discuss

Q #9 | Multiple Select Type | Award: 2 | Penalty: 0 | Compiler Design

A node p in a control flow graph(CFG) dominates a node q if every path from the entry node to q goes through p. We say that node p is a dominator of node q.
The dominator set of node q, $\mathrm{DOM}(q)$, is formed by all nodes that dominate q. By definition, each node dominates itself, therefore, $q \in \mathrm{DOM}(q)$.
Consider the following control flow graph(CFG) of a program P in low level intermediate representation, which has 10 basic blocks(nodes) :



Which of the following is/are correct?

A. $\mathrm{DOM}(1) = \{1\}$
B. $\mathrm{DOM}(2) = \{1, 2\}$
C. $\mathrm{DOM}(3) = \{1, 2, 3\}$
D. $\mathrm{DOM}(10) = \{1, 2, 10\}$

Your Answer: A | Correct Answer: A;B;C;D | Incorrect | Discuss

Q #10 | Numerical Type | Award: 2 | Penalty: 0 | Compiler Design

Consider the following program :

```
    u = v + 1
    w = u - v
    x = x + w
    y = u - w
5.  z = x + y
```

The above code segment is executed on a processor which allows only register operands in its instructions. Each instruction can have at most two source operands and one destination operand. Assume that all variables are dead after this code segment.

What is the minimum number of registers needed in the instruction set architecture of the processor to compile this code segment without any spill to memory? Do not apply any optimization other than optimizing register allocation.

Your Answer: 3 | Correct Answer: 3 | Correct | Discuss

Q #11 | Numerical Type | Award: 2 | Penalty: 0 | Compiler Design

Consider the following program.

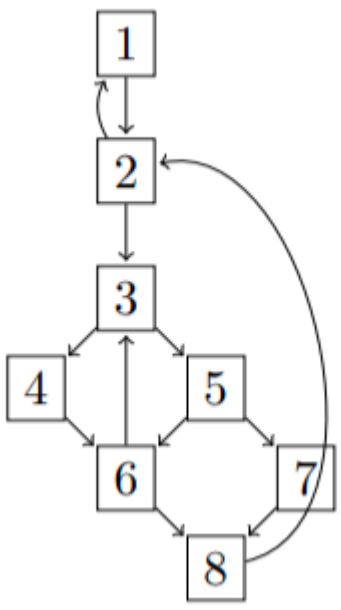
```
    L0: e := 0
    b := 1
    d := 2
    L1: a := b + 2
 5. c := d + 5
    e := e + c
    f := a * a
    if f < c goto L3
    L2: e := e + f
10. goto L4
    L3: e := e + 2
    L4: d := d + 4
    b := b - 4
    if b != d goto L1
15. L5:
```

Identify the basic blocks and draw the CFG(control flow graph) for the code above. Let the number of basics blocks(nodes) be M and edges be N then $\mathrm{M}+\mathrm{N}$ is _____ (We have special designated entry and exit nodes in the CFG which should be included in M, N.)

Your Answer: 11 | Correct Answer: 17 | Incorrect | Discuss

Q #12 | Numerical Type | Award: 2 | Penalty: 0 | Compiler Design

Consider an intermediate representation(IR) that has only assignment statements and unconditional, conditional goto(branch) statements.
Consider the following control flow graph of a program P which has 8 basic blocks :



"Minimum" how many Branch statements(conditional or unconditional) does the program P has _____

Your Answer: 6 | Correct Answer: 5 | Incorrect | Discuss

Q #13 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Compiler Design

Which of the following three-Address code satisfies the below expression?

$$a + (b \times a) + b + c + d$$

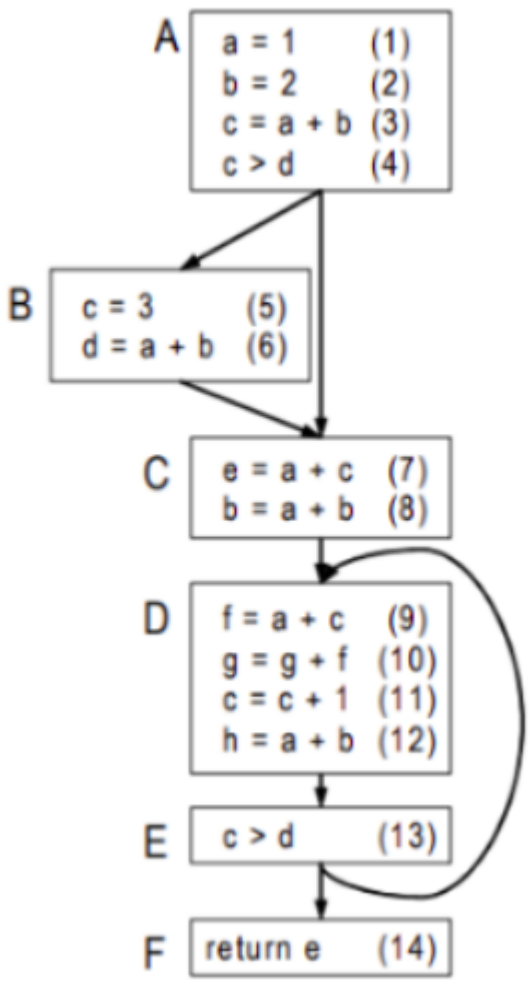
A. $t_1 = a + b, t_2 = b \times t_1, t_3 = t_2 + c, t_4 = t_3 + d$
B. $t_1 = a + b, t_2 = b \times t_1, t_3 = a + t_2, t_4 = t_3 + c, t_5 = t_4 + d$

C. $t_1 = a \times b, t_2 = b \times t_1, t_3 = a + t_2, t_4 = t_3 + c, t_5 = t_4 + d$
D. None of these

Your Answer: D | Correct Answer: D | Correct | Discuss

Q #14 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Compiler Design

Consider the following Control Graph G :



For the above CFG of basic blocks, which of the following is Correct?

A. All possible statements have been combined to form the right number of Basic Blocks.
B. The Basic Block C and D can be combined together
C. The Basic Block D and E can be combined together
D. The Basic Block E and F can be combined together

Your Answer: C | Correct Answer: C | Correct | Discuss

Q #15 | Numerical Type | Award: 2 | Penalty: 0 | Compiler Design

Consider the following program.

```
    L0: e := 0
    b := 1
    d := 2
    L1: a := b + 2
 5. c := d + 5
    e := e + c
    f := a * a
    if f < c goto L3
    L2: e := e + f
10. goto L4
    L3: e := e + 2
    L4: d := d + 4
    b := b - 4
    if b != d goto L1
15. L5:
```

This program uses six temporaries, a-f. Assume that the only variable that is live on exit from this program is e.

Maximum how many variables will be live simultaneously (at some program point)?

Your Answer: | **Correct Answer: 5** | Not Attempted | Discuss