Covered Topics Under UNIT-3 of "CD- COMPILER DESIGN (KIT-052)"

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CD: UNIT-3

Syntax-Directed Translation

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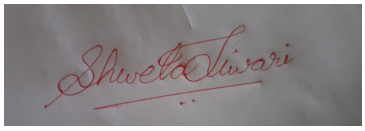

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TOPIC On : UNIT-3

3 Address Code for (IF then ELSE, BOOLEAN, WHILE and For LOOP)

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By SHWETA TIWARI

Under On: Syntax-Directed Translation

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Unit-3

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3-Address Code for [conditional statement, loops, switch case and boolean expression].

Here, we write 3-address code for [conditional statement, loops, switch case and boolean expression] like as (if then else, while and for loop, boolean expression (OR, AND, NOT) switch case as well.

The only 2 things are important for 3-address code for different cases.

1. for condition we use only **if**
2. for Jump we use **goto**

[1] 3-Address Code for (if-then else)

if (a < b) then x = y + z else p = q + r

1. if (a < b) goto (3) — true
2. goto (6) — false
3. $t_1 = y + z$
4. $x = t_1$
5. goto --

6. $t_2 = q + r$
7. $p = t_2$
8. goto --

(2) 3- Address code for while loop

while (a<b) do x = y + z

1. if (a<b) goto (3) — true
2. goto --- — false
3. $t_1 = y + z$
4. $x = t_1$
5. goto (1)

(3) 3-Address code for loop.

for (i=1; i<=20; i++)
x = y + z

1. i = 1
2. if (i<=20) goto (7) — true
3. goto --- — false
4. $t_1 = i + 1$
5. $i = t_1$
6. goto (2)
7. $t_2 = y + z$
8. $x = t_2$
9. goto (4)

(4) 3-Address Code for boolean expression

if (a<b) AND (c>d) then p = q+r

(1) if (a<b) goto (3). — true
(2) goto ---. — false
(3) if (c>d) goto (5) --- true
(4) goto --- — false
(5) $t_1 = q + r$
(6) $p = t_1$
(7) goto --

Switch Cases

```
switch (i+j)
{ case 1: x = y+z
  case 2: u = v+w
  default: p = q+r
}
```

1. $t_1 = i + j$
2. if $t_1 = 1$ goto 5
3. if $t_1 = 2$ goto 8
4. goto 11
5. $t_2 = y + z$
6. $x = t_2$
7. goto ---
8. $t_3 = v + w$
9. $u = t_3$
10. goto ---
11. $t_4 = q + r$
12. $p = t_4$
13. goto ---

Question Write 3-address code for (if-then else).

if (z > y) then z = z + 1

1. if (z > y) then goto (3) — true
2. goto ___ — false
3. $t_1 = z + 1$
4. $z = t_1$
5. goto ___

Question write 3-address code for (if-then else or nested if-else)

if (a < b) then x = y + z
else
if (d > c) then p = q + r
else
u = v + w

1. if (a < b) then goto (4) — true
2. goto (6) — false
3. $t_1 = y + z$
4. $x = t_1$
5. goto ___

6) if (d > c) then goto (8) true

7) goto (11)

8) $t_2 = q + r$

9) $p = t_2$

10) goto ---

11) $t_3 = v + w$

12) $u = t_3$

13) goto ---

Question

```
while (A<C) and (B>D) do
    if (A=1) then C=C+1
    else
        while (A<=D) do
            A=A+3
```

1. if (A<C) goto 3 — true
2. goto 15 — false
3. if B>D goto 5 — true
4. goto 15 — false
5. if (A=1) goto 7 — true
6. goto 10 — false
7. $t_1 = C+1$
8. $C = t_1$
9. goto 1
10. if (A<=D) goto 12 — true
11. goto 1 — false
12. $t_2 = A+3$
13. $A = t_2$
14. goto 10
15. goto

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Question switch Case (Generate 3-Address code for the following code)

```
switch (z+1)
{ case 1 : C = A+B
  case 2 : Z = X+Y
  case 3 : R = S+T
  default : U = V+W
}
```

Answer

```
(1)   t1 = z+1
(2)   if t1 = 1   goto (6)
(3)   if t1 = 2   goto (9)
(4)   if t1 = 3   goto (12)
(5)   goto (15)
(6)   t2 = A+B
(7)   C = t2
(8)   goto ---
(9)   t3 = X+Y
(10)  Z = t3
(11)  goto --
(12)  t4 = S+T
(13)  R = t4
(14)  goto ---
```

15. $t_5 = V + W$

16. $U = t_5$

17. goto ---

Question Generate 3-Address code for following code

```
While ((A<C) and (B>D)) do
    if A=1 then C=C+1
else
    while(A<=D)
    do A=A+B
```

Answer

```
(1)  if (A<C) goto (3)
(2)  goto (15)
(3)  if (B>D) goto (5)
(4)  goto (15)
(5)  if A=1 goto (7)
(6)  goto (10)
(7)  t1 = C+1
(8)  C = t1
(9)  goto (1)
(10) if (A<=D) goto (12)
(11) goto (1)
(12) t2 = A+B
(13) A = t2
(14) goto (10)
(15) goto ----
```

Question Using Backpatching, generate an intermediate code for the following expression

A<B OR C<D AND P<S

Answer

1. if (A<B) goto (7)
2. goto ---
3. if (C<D) goto (5)
4. goto ---
5. if (P<S) goto (7)
6. goto --
7. next statement

Question Generate three-address code for the following code.

```
c=0
do {
    if (a<b) then
        x++;
    else
        x--;
    c++;
} while (c<5)
```

Answer

(1)
(2) c=0
(3) if (a<b) goto (4)
(4) goto (7)
(5) $t_1 = x+1$
(6) $x = t_1$
(7) ~~t2 = x+1~~ goto (9)
(8) $t_2 = x+1$
(9) $x = t_2$
(10) $t_3 = c+1$
(11) $c = t_3$
(12) ~~goto ---~~ if (c<5) goto (2)
goto ---