Systems Software: P-Machine Example #1

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PL/0 Language

► The high level language used for the P-Machine

```
/* constant declaration */
const n = 13;
                         /* variable declaration */
var i,h;
procedure sub;
                         /* subroutine declaration */
 const k = 7;
 var j,h;
 begin
  j:=n;
  i:=1;
  h:=k;
 end;
                         /* main routine starts here */
begin
 i:=3;
 h:=0;
 call sub;
end.
```

The compiled PL/0 language

- The previous code is compiled into the assembly language for the P-Machine
- We will go over the execution of this code while watching the state of the machine

Execution SP PC BP

AR Stack

PC BP SP

AR Stack

0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 PC BP SP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 14 STO 0 4 ????? 15 CAL 0 2 16 OPR 0 0

AR Stack

PC BP SP ????3

AR Stack

BP SP PC

???3?

AR Stack

BP SP PC

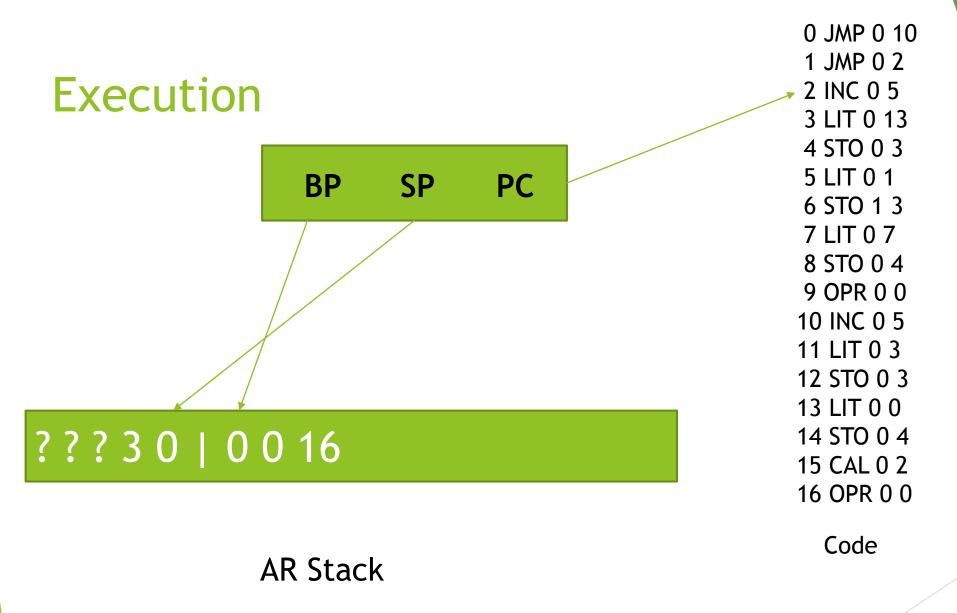
???3?0

AR Stack

BP SP PC

???30

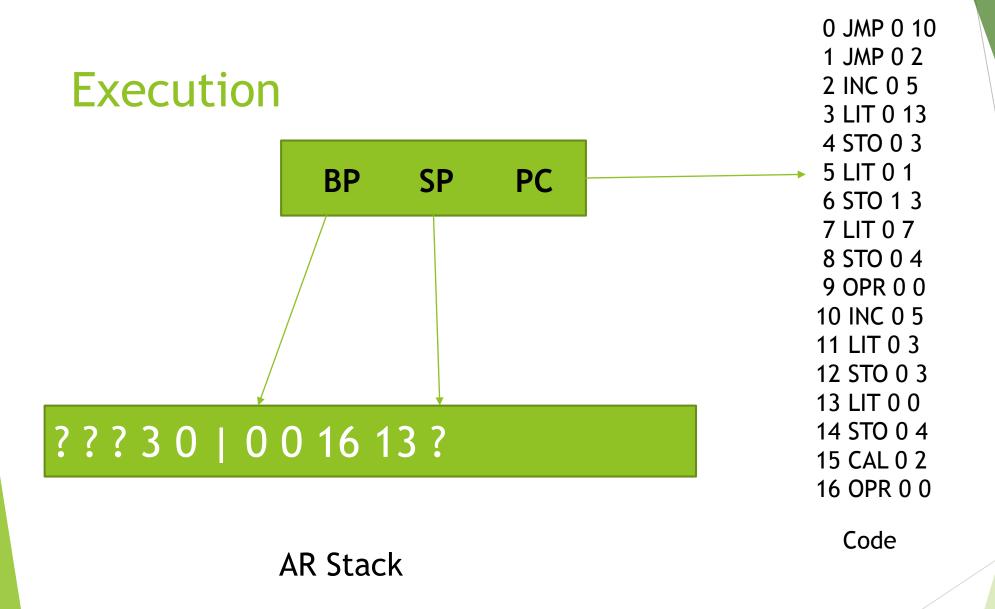
AR Stack



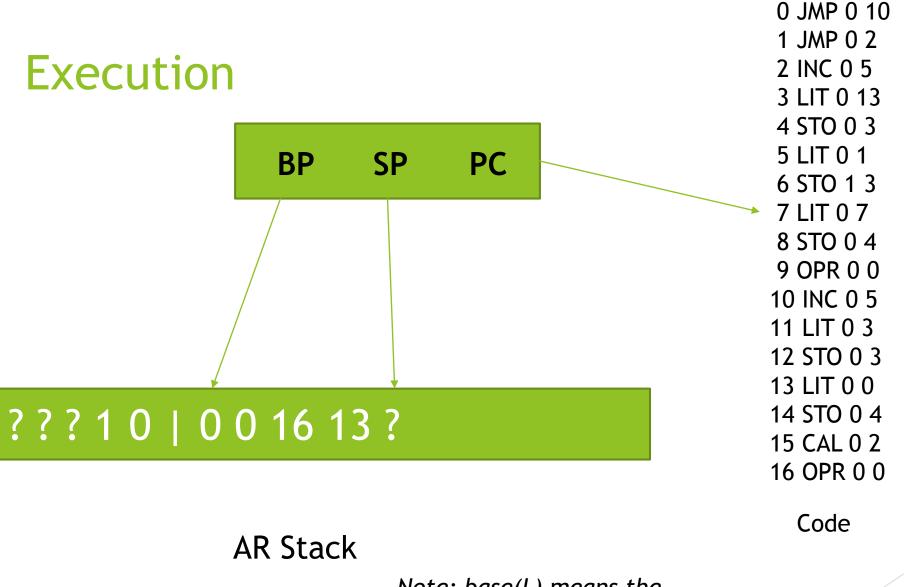
Note: In this example, both the static and dynamic link are the same. This is not always the case.

0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 > 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 PC BP SP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 ???30 | 0016?? 14 STO 0 4 15 CAL 0 2 16 OPR 0 0 Code **AR Stack**

0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 PC SP BP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 ???30 | 0016??13 14 STO 0 4 15 CAL 0 2 16 OPR 0 0 Code **AR Stack**



0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 PC BP SP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 ???30|001613?1 14 STO 0 4 15 CAL 0 2 16 OPR 0 0 Code **AR Stack**



Note: base(L) means the base of the AR L static levels above the current AR

0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 SP PC BP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 ???10|001613?7 14 STO 0 4 15 CAL 0 2 16 OPR 0 0 Code **AR Stack**

0 JMP 0 10 1 JMP 0 2 Execution 2 INC 0 5 3 LIT 0 13 4 STO 0 3 5 LIT 0 1 SP PC BP 6 STO 1 3 7 LIT 0 7 8 STO 0 4 9 OPR 0 0 10 INC 0 5 11 LIT 0 3 12 STO 0 3 13 LIT 0 0 ???10|0016137 14 STO 0 4 15 CAL 0 2 16 OPR 0 0 Code **AR Stack**

BP SP PC

???10

AR Stack

BP SP PC

AR Stack