- Week 2 and 3

Pseudocode & Algorithm

- **Example 1:** Write an algorithm to determine a student's final grade and indicate whether it is passing or failing. The final grade is calculated as the average of four marks.

Pseudocode & Algorithm

- Detailed Algorithm

    Step 1:   Input M1,M2,M3,M4

        Step 2:   GRADE ← (M1+M2+M3+M4)/4

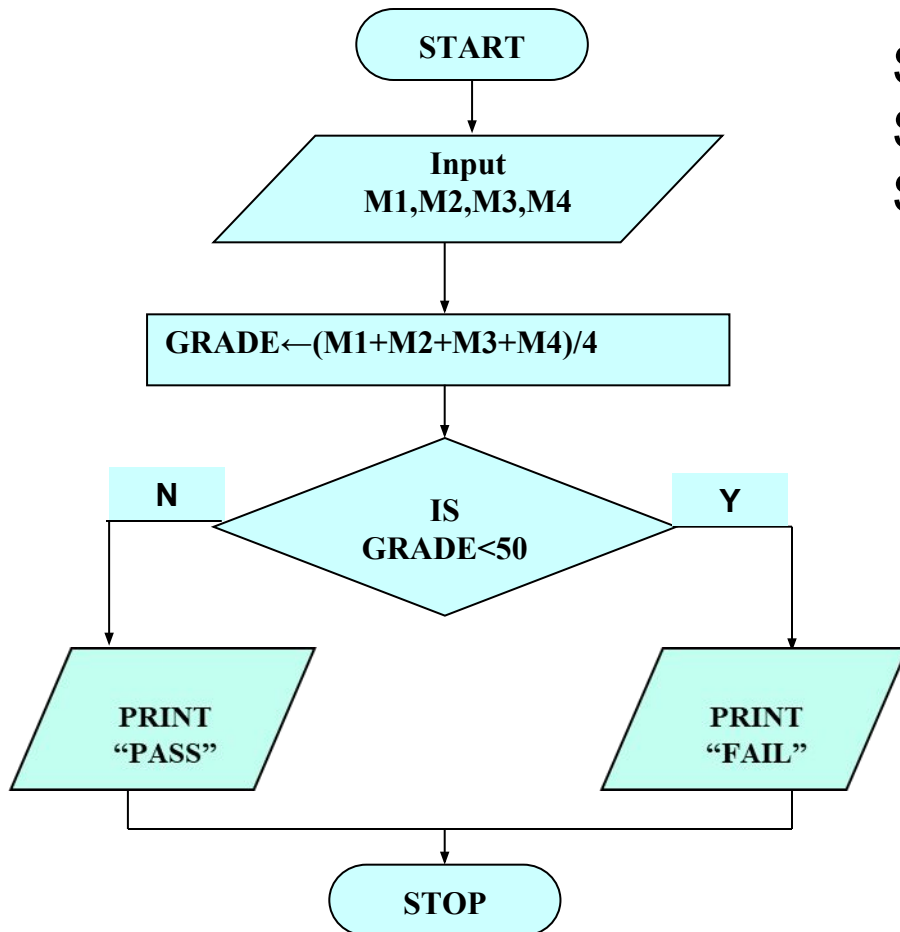   Step 3:   if (GRADE < 60) then

                Print "FAIL"

        else

                Print "PASS"

        endif

Example 1

START

Input
M1,M2,M3,M4

GRADE←(M1+M2+M3+M4)/4

N IS GRADE<50 Y

PRINT "PASS"

PRINT "FAIL"

STOP

Step 1: Input M1,M2,M3,M4
Step 2: GRADE ← (M1+M2+M3+M4)/4
Step 3: if (GRADE <50) then
            Print "FAIL"
      else
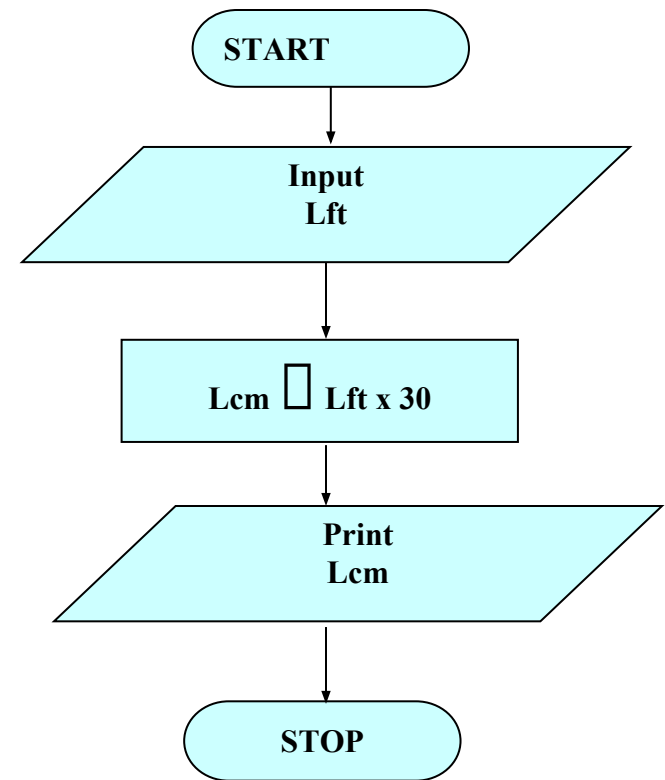   Print "PASS"
      endif

Example 2

- Write an algorithm and draw a flowchart to convert the length in feet to centimeter.

Example 2

Algorithm

- Step 1: Input Lft
- Step 2:   Lcm ☐Lft x 30
- Step 3:   Print Lcm

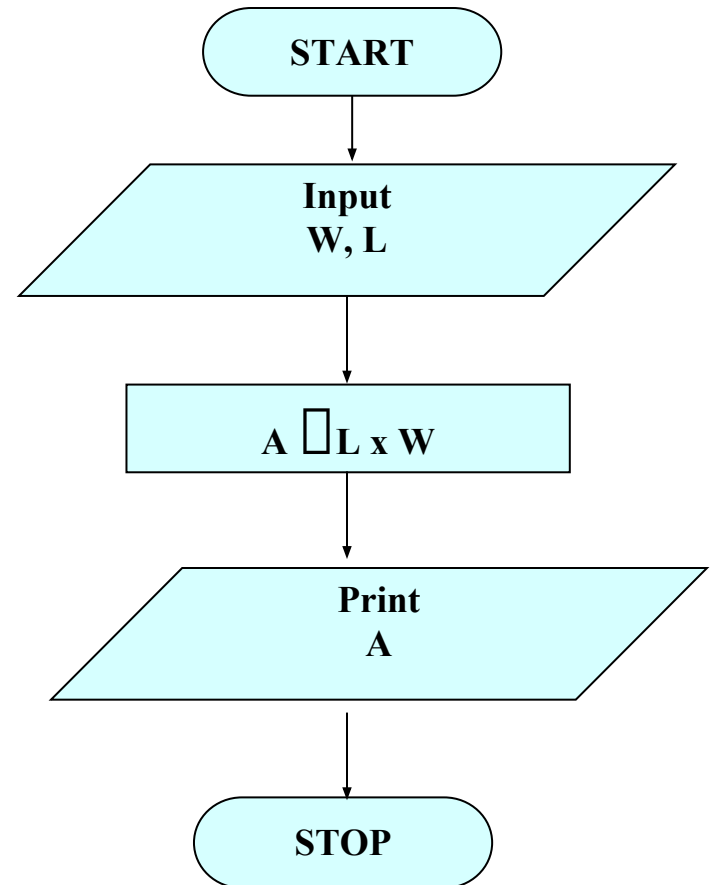START

Input
Lft

Lcm ☐ Lft x 30

Print
Lcm

STOP

Example 3

Write an algorithm and draw a flowchart that will read the two sides of a rectangle and calculate its area.

Example 3

Algorithm

- Step 1:   Input W,L
- Step 2:   A ⬜L x W
- Step 3:   Print A

Example 6

- We want to create a flowchart that prints out the biggest of three inputted numbers

Example 6

Step 1: *Input* **A, B, C**
Step 2: *if (A>B) then*
     if (A>C) then
      MAX □A **[A>B, A>C]**
    else
      MAX □C **[C>A>B]**
    endif
   else
    if (B>C) then
      MAX □B **[B>A, B>C]**
    else
      MAX □C **[C>B>A]**
    endif
   endif
Step 3: *Print "The largest number is", MAX*

Example 6

- **Flowchart: Draw the flowchart of the above Algorithm.**

- On the following slide, a number of potential boxes you could use to correctly implement the algorithm.

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           │
                           ▼
                    ┌─────────────┐
                    │ Read A, B, C│
                    └──────┬──────┘
                           │
                           ▼
                        ◇ A>B ? ◇
```

START

Read A, B, C

A>B ?

Y es

Y es

N o

N o

N o

N o

Y es

END

- *Pick the appropriate three of the following boxes that describe the algorithm as described.*

B<C?

B>C?

Print A

A<C?

A>C?

Print B

A<B?

A>B?

Print C

```
                            ┌─────────────┐
                            │    START    │
                            └─────────────┘
                                   │
                                   ▼
                            ┌─────────────┐
                            │ Read A, B, C│
                            └─────────────┘
                                   │
                                   ▼

  Y        ╱╲          Y      ╱╲            N      ╱╲         Y
 ───      ╱  ╲        ───    ╱  ╲          ───    ╱  ╲       ───
 es      ╱A>C ╲ ◄─────es────╱A>B ?╲────────o────►╱B>C ?╲     es
  │      ╲    ╱              ╲    ╱               ╲    ╱      │
  │       ╲  ╱                ╲  ╱                 ╲  ╱       │
  │        ╲╱  N               ╲╱                   ╲╱  N     │
  │        │  ───               │                   │  ───    │
  │        ▼   o                │                   ▼   o     │
  │   ─────────────────────────────────────────────────      │
  │                            │                             │
  ▼                            ▼                             ▼
┌─────────┐            ┌─────────┐               ┌─────────┐
│ Print A │            │ Print B │               │ Print C │
└─────────┘            └─────────┘               └─────────┘
     │                      │                          │
     ▼                      ▼                          ▼
     └──────────────────────┼──────────────────────────┘
                            ▼
                     ┌─────────────┐
                     │     END     │              14
                     └─────────────┘
```
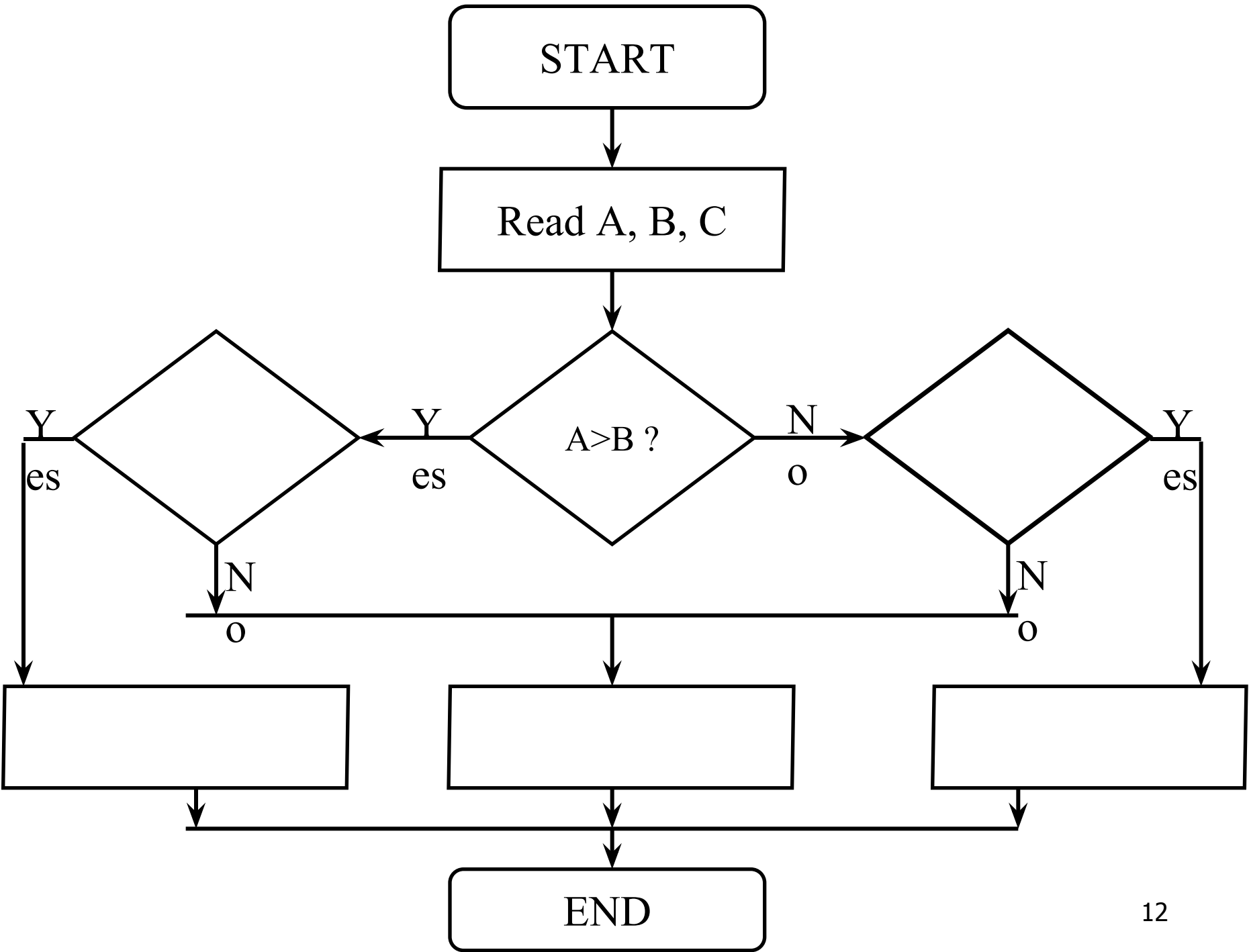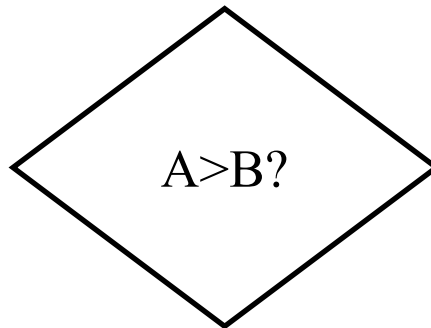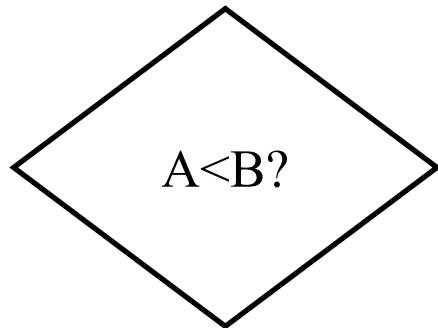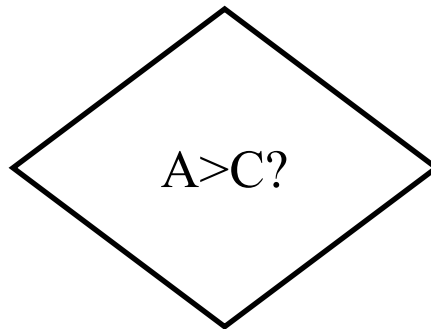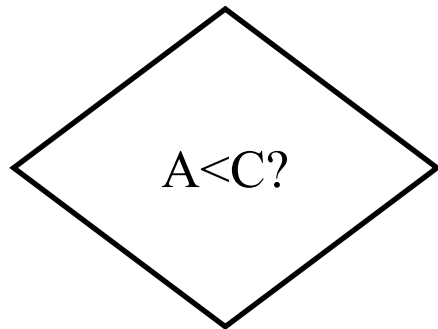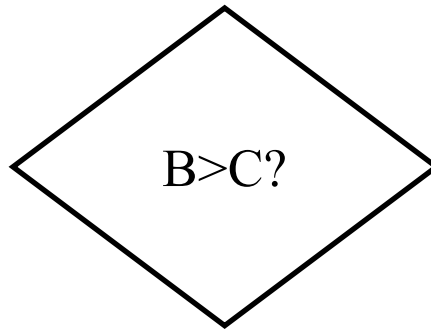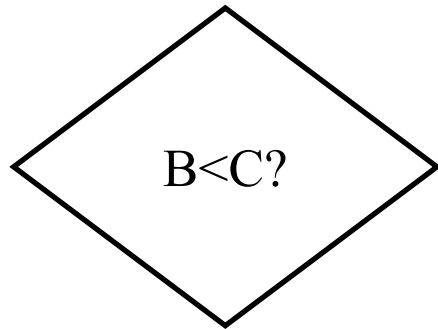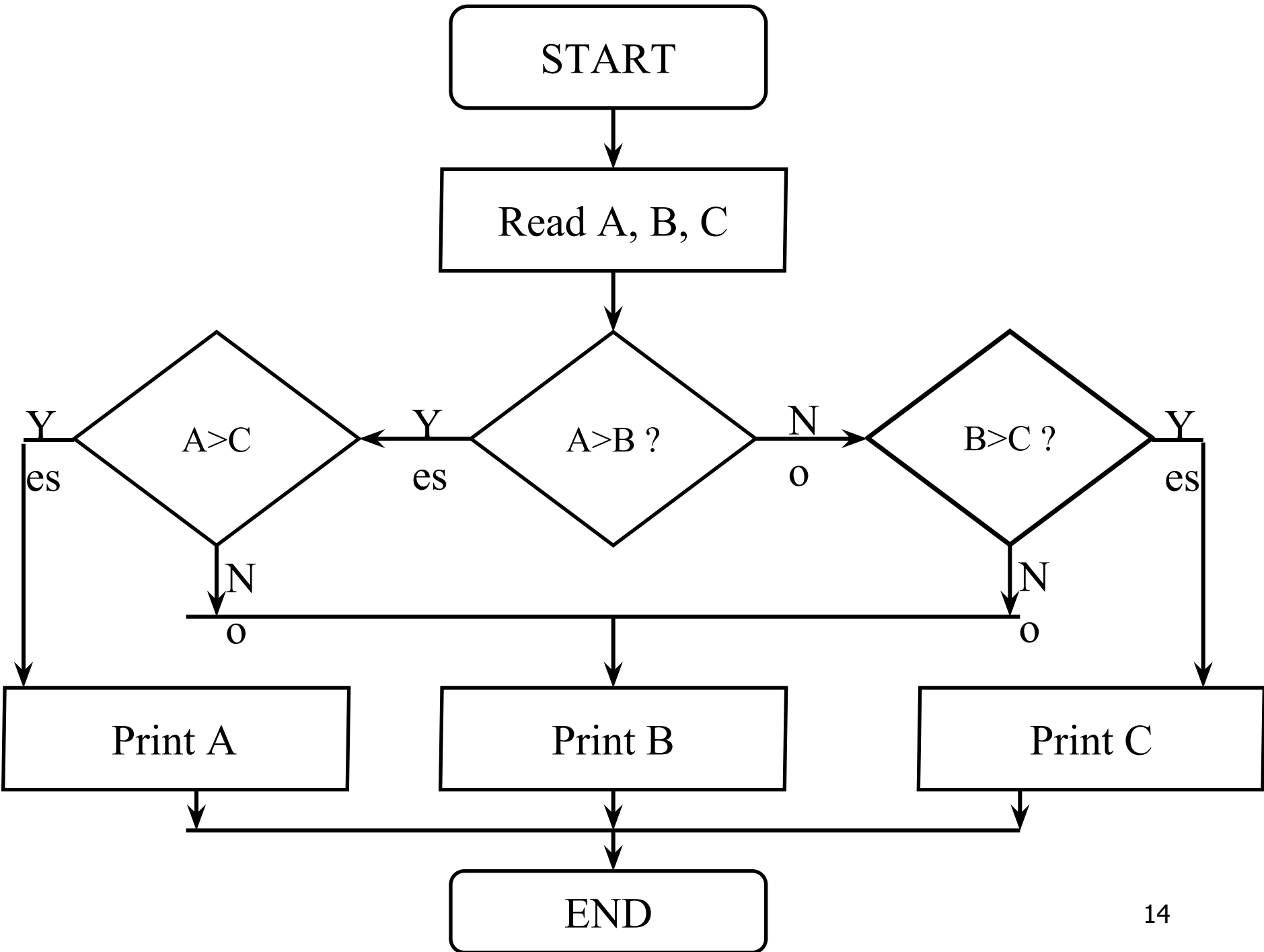
Example 7

- We want to create a flowchart that prints out the word "Honour" if the number input is 70, if the number is less than 40 print out the word "Fail", otherwise print out the word "Pass".
- On the following slide, a number of potential boxes you could use to correctly implement the algorithm.

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │   Read A    │
                    └──────┬──────┘
                           │
                          ◇
              Yes       ◇   ◇      No
         ┌───────────◇       ◇───────────┐
         │            ◇     ◇            │
         │              ◇ ◇              ▼
         │                              ◇
         │                    No      ◇   ◇      Yes
         │               ┌─────────◇       ◇─────────┐
         │               │          ◇     ◇          │
         │               │            ◇ ◇            │
         ▼               ▼                            ▼
   ┌──────────┐    ┌──────────┐              ┌──────────┐
   │          │    │          │              │          │
   └────┬─────┘    └────┬─────┘              └────┬─────┘
        │               │                         │
        └───────────────┼─────────────────────────┘
                        │
                 ┌──────▼──────┐
                 │     END     │
                 └─────────────┘
```
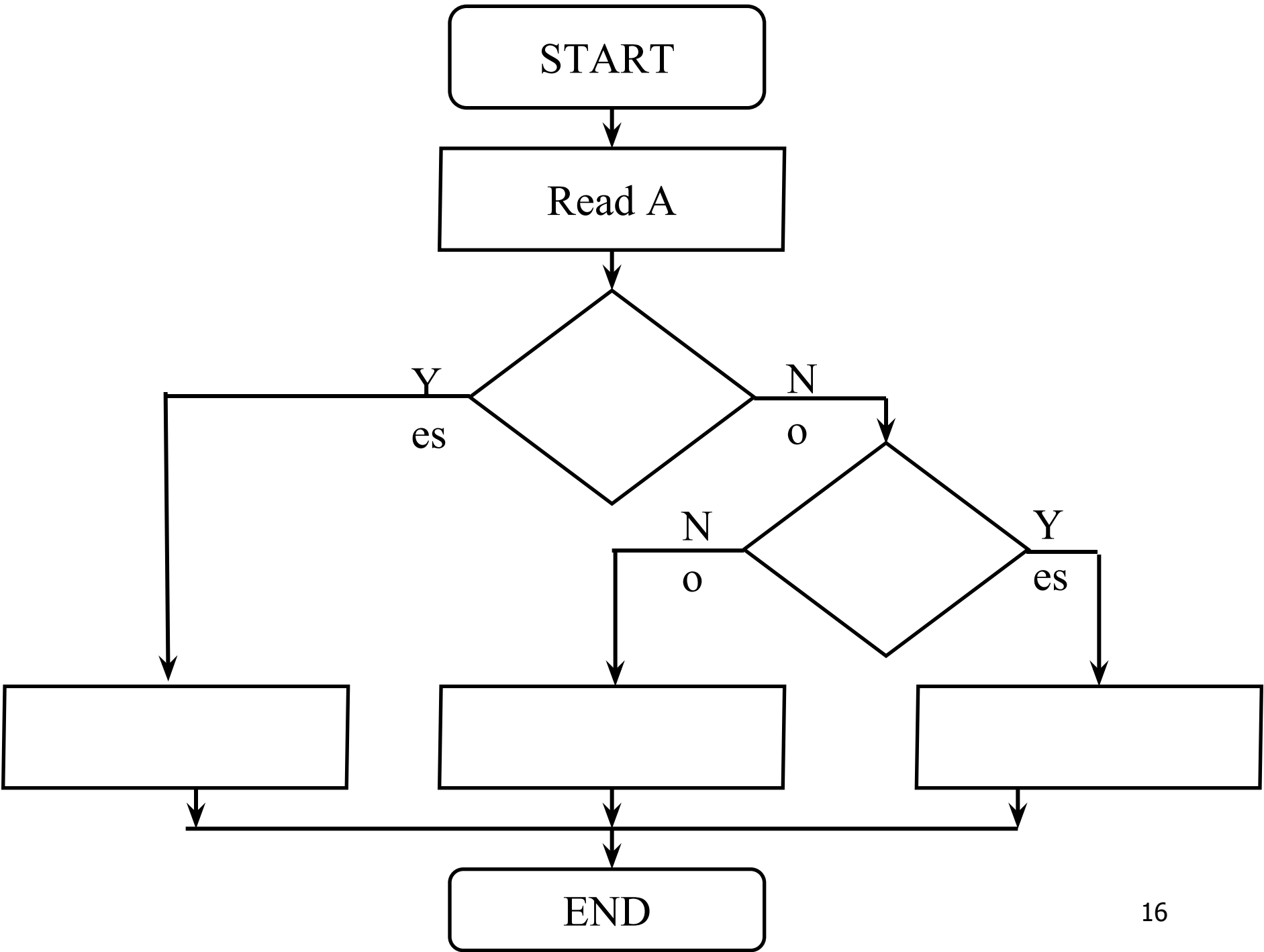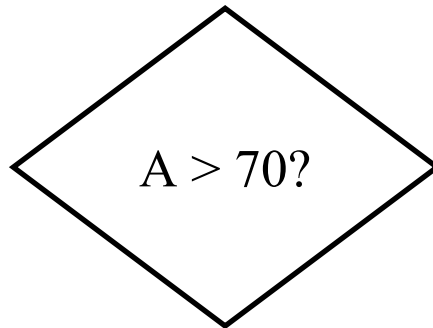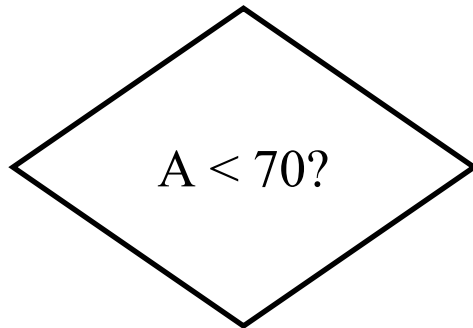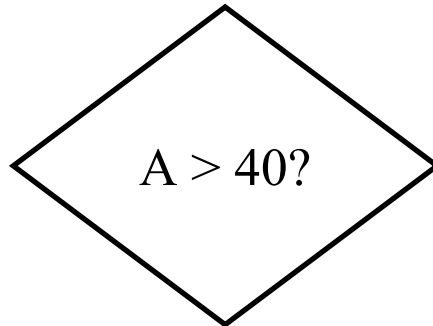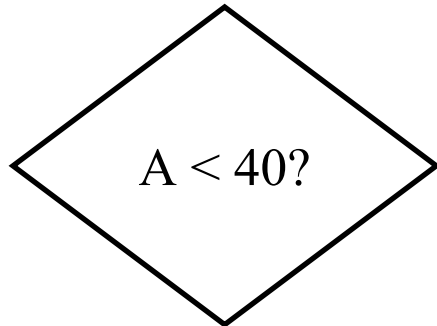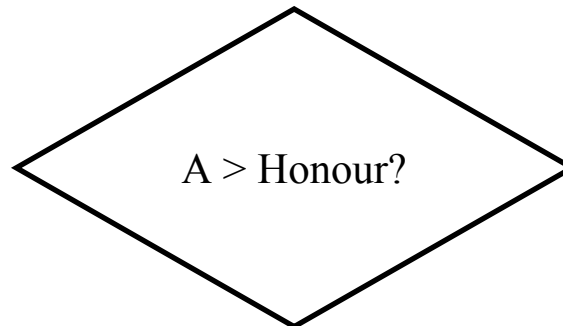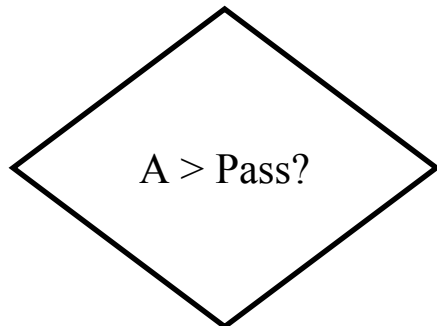
- *Pick the appropriate three of the following boxes that describe the algorithm as described*

A < 70?

A > 70?

Print "Honour"

A < 40?

A > 40?

Print "Fail"

A > Pass?

A > Honour?

Print "Pass"

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │   Read A    │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
         Y          ╱   A<40?   ╲          N
      ◄────────────◄              ►────────────┐
        es          ╲            ╱      o        │
                     ╲          ╱                │
                                           ┌─────▼─────┐
                        N                 ╱   A<70    ╲        Y
                     ┌─◄───────────────◄               ►──────────┐
                     │    o              ╲           ╱    es       │
                     │                    ╲         ╱              │
  ┌────────┐    ┌────▼────┐          ┌─────▼────┐           ┌──────▼──────┐
  │  Fail  │    │  Pass   │          │          │           │   Honour    │
  └───┬────┘    └────┬────┘          └──────────┘           └──────┬──────┘
      │              │                                             │
      └──────────────┼─────────────────────────────────────────────┘
                     │
              ┌──────▼──────┐
              │     END     │                                    18
              └─────────────┘
```
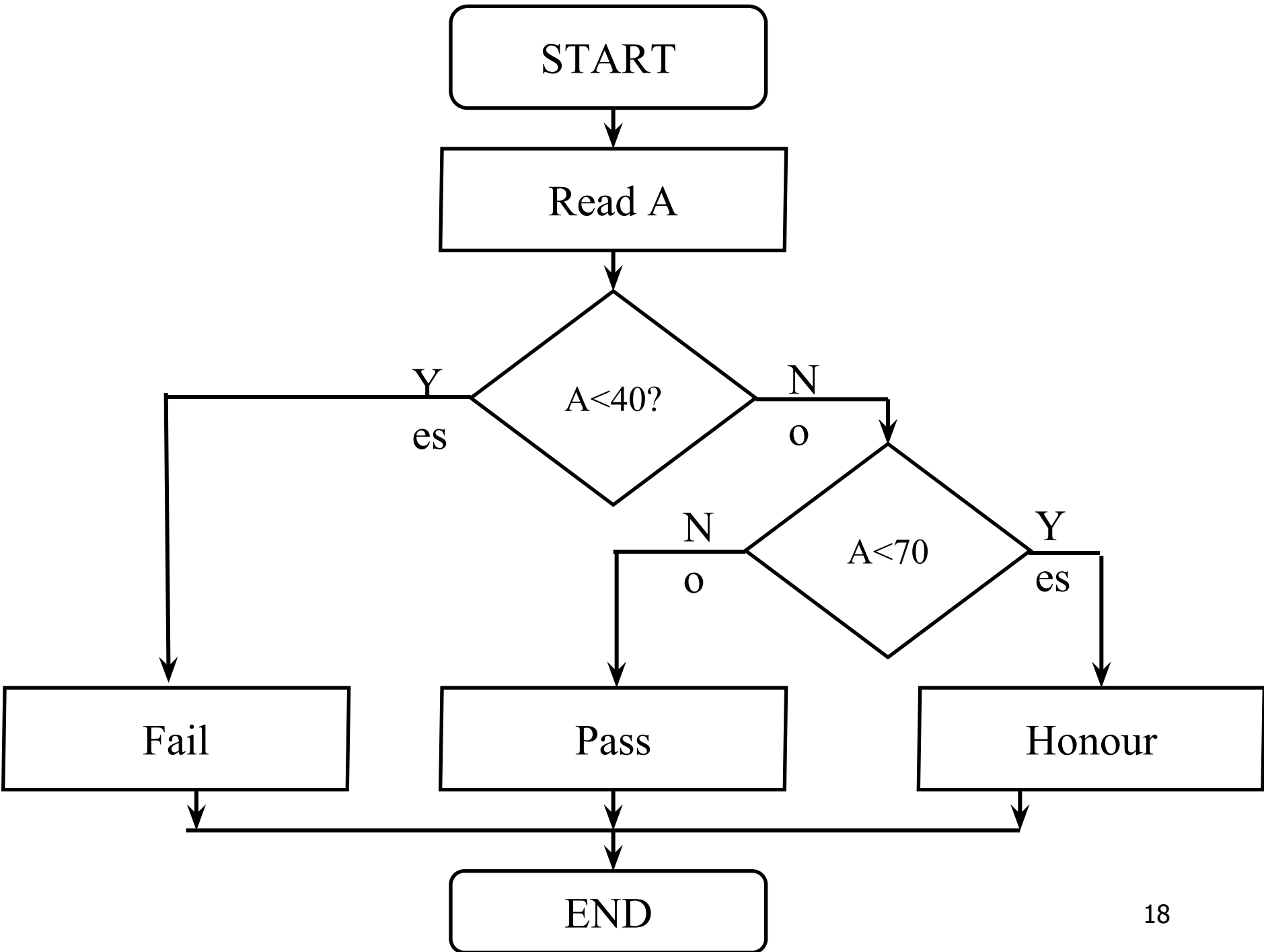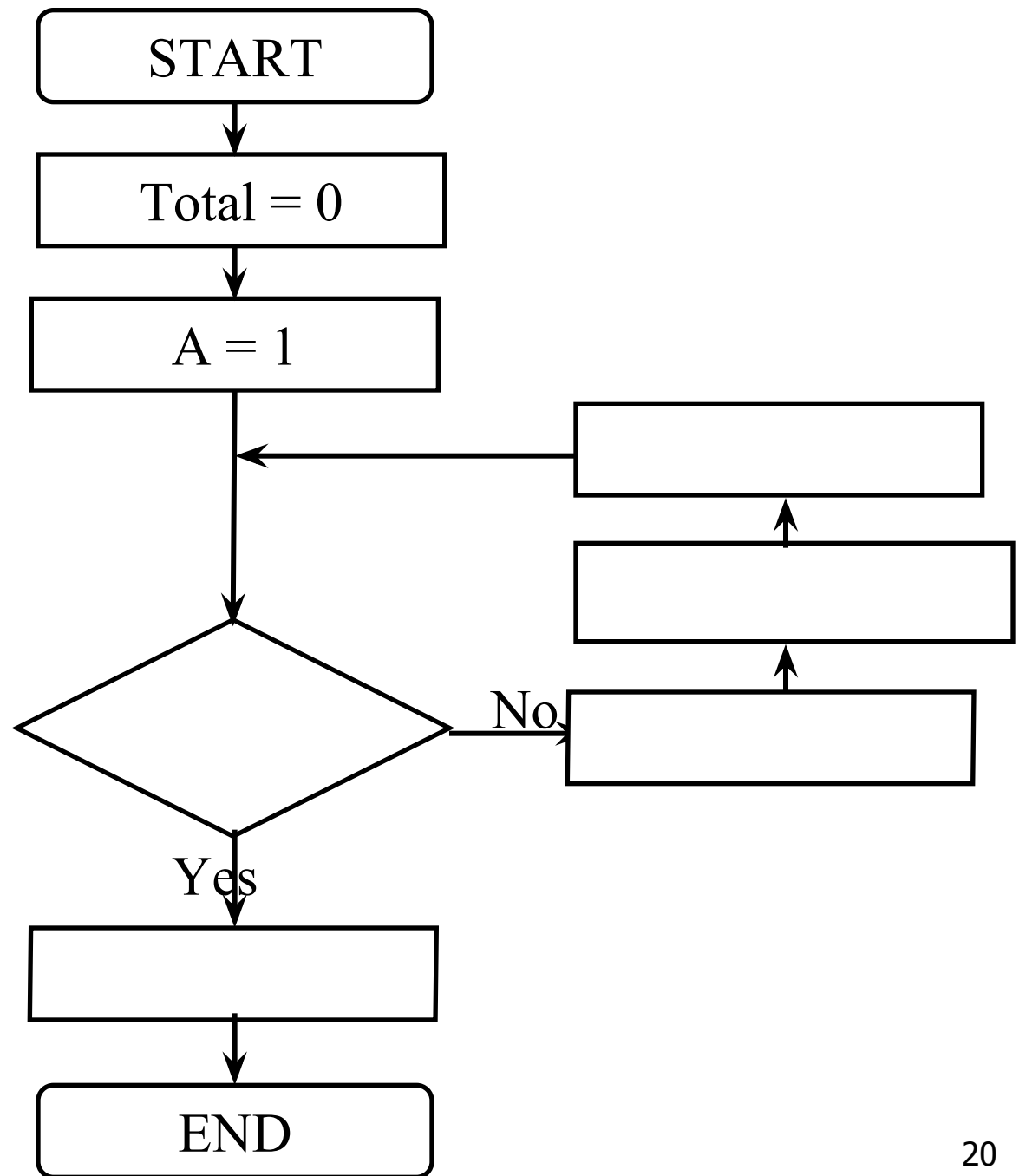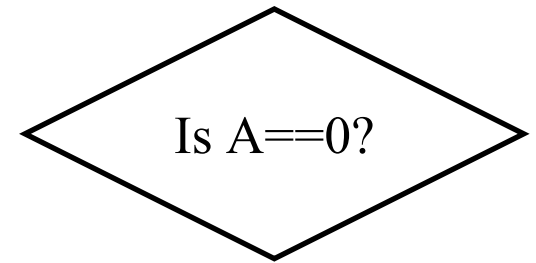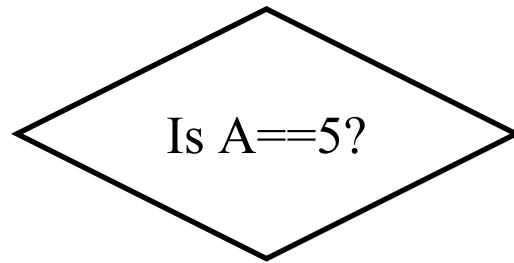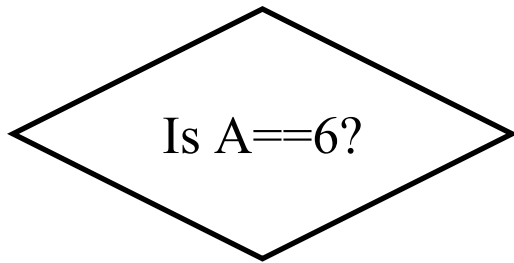
Example 8

- We want to create a flowchart that prints out the average value of five numbers input in.
- On the following slide, a number of potential boxes you could use to correctly implement the algorithm.

```
┌─────────────────┐
│      START      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│    Total = 0    │
└─────────────────┘
         │
         ▼
┌─────────────────┐                              ┌─────────────────────┐
│      A = 1      │                              │                     │
└─────────────────┘                              └─────────────────────┘
         │                                                  ▲
         │                                       ┌─────────────────────┐
         │                                       │                     │
         ▼                                       └─────────────────────┘
       ◇◇◇◇◇                                              ▲
     ◇       ◇                         No        ┌─────────────────────┐
    ◇         ◇ ─────────────────────────────────│                     │
     ◇       ◇                                    └─────────────────────┘
       ◇◇◇◇◇
         │
        Yes
         │
         ▼
┌─────────────────┐
│                 │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│      END        │
└─────────────────┘
```

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- *Pick the appropriate three of the following boxes that describe the algorithm as described.*

Is A==6?	Is A==5?	Is A==0?
Print Total	Print Total / 5	Print Total++
Total = X	Total = Total	Total = Total + X
Read A	Read Total	Read X

```
                    START
                      │
                      ▼
                  Total = 0
                      │
                      ▼
                    A = 1
                      │
                      │              A = A + 1
                      │                  ▲
                      │                  │
                      │           Total = Total +X
                      │                  ▲
                      ▼                  │
                   A == 6  ──No──▶    Read X
                      │
                     Yes
                      │
                      ▼
                 Print Total
                      │
                      ▼
                    END
```

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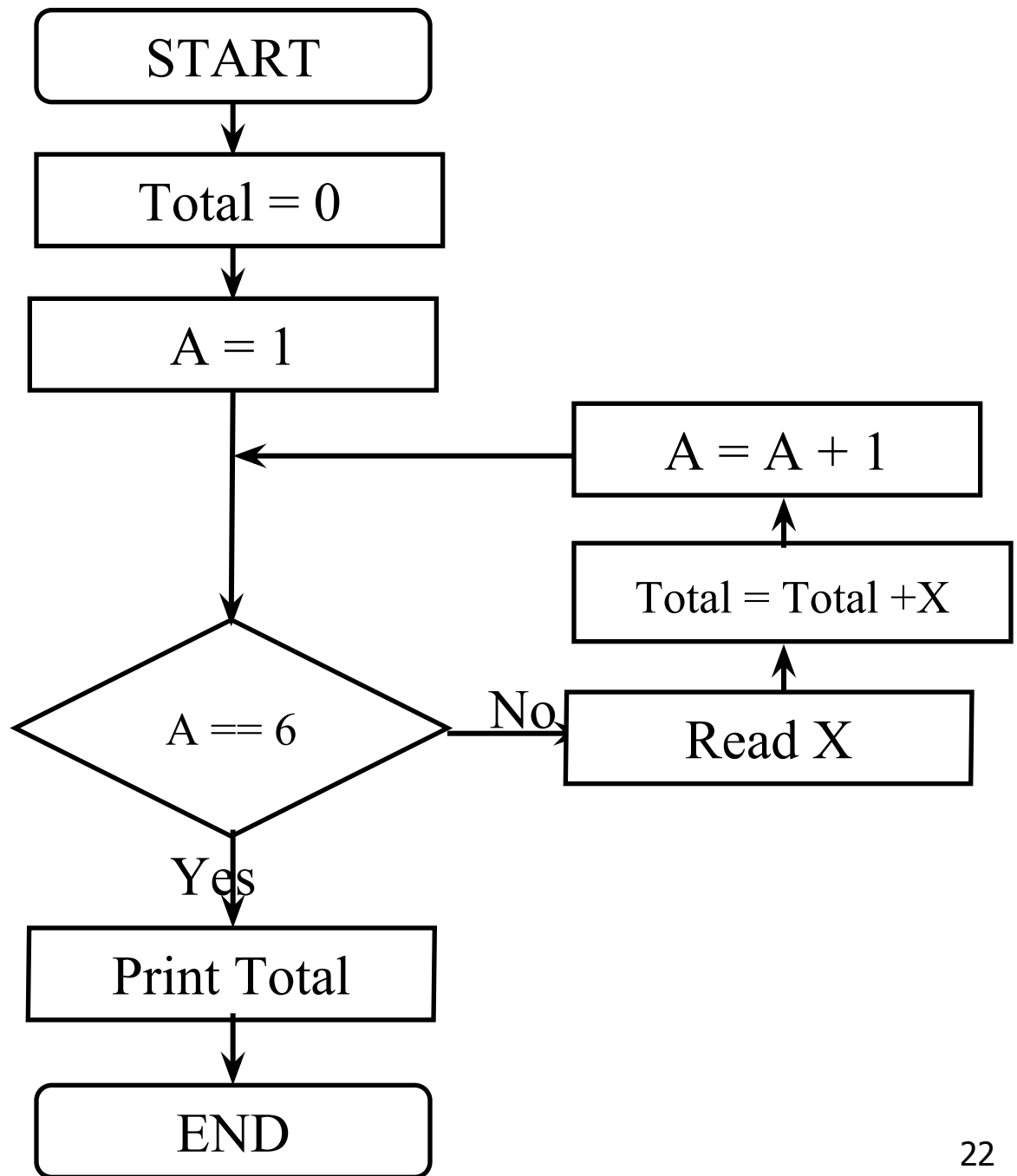
Example 9

- Write an algorithm and draw a flowchart that will calculate the roots of a quadratic equation
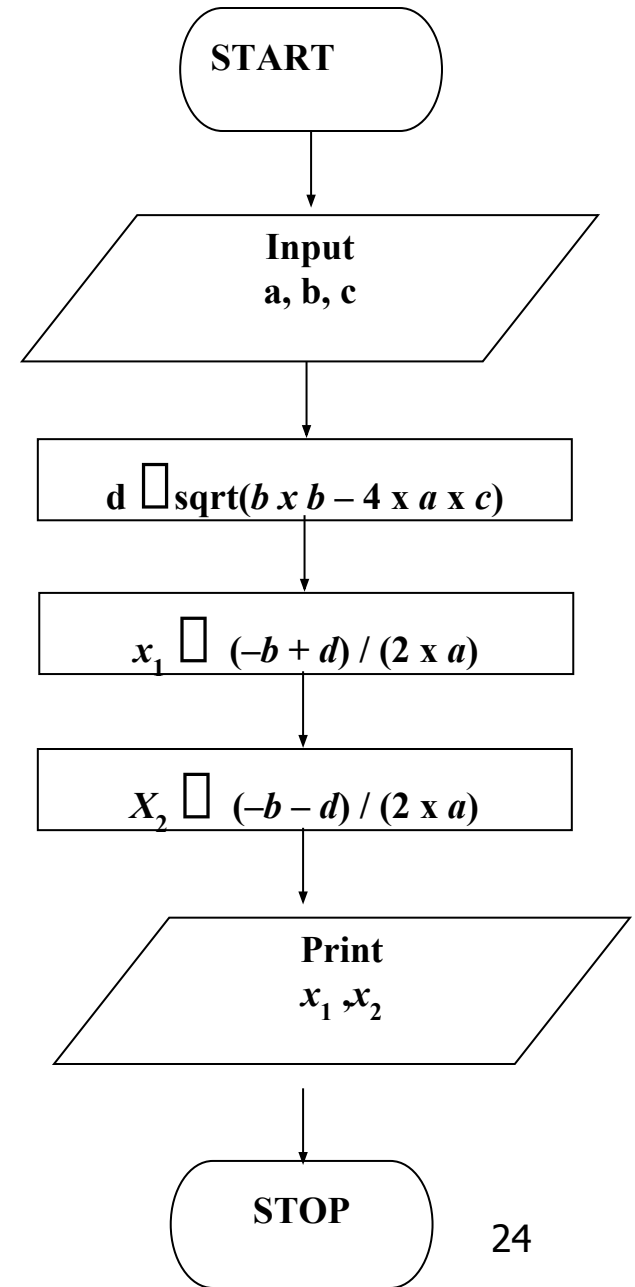
  $$ax^2 + bx + c = 0$$

- Hint: **d** = sqrt $(b^2 - 4ac),$

- and the roots are:

- If d<0 no solution

- else

  $$\boldsymbol{x1} = (-b + d)/2a \quad \text{and} \quad \boldsymbol{x2} = (-b - d)/2a$$

Example 9

Input
a, b, c

- **Algorithm**:
- Step 1:   Input a, b, c
- Step 2: $d \Box \text{sqrt} ($ $b \times b - 4 \times a \times c)$
- Step 3: $x1 \Box (-b + d) / (2 \text{ x } a)$
- Step 4: $x2 \Box (-b - d) / (2 \text{ x } a)$
- Step 5:   Print $x1, x2$

$d \Box \textbf{sqrt}(b \textbf{ x } b - 4 \textbf{ x } a \textbf{ x } c)$

$x_1 \Box (-b + d) / (2 \textbf{ x } a)$

$X_2 \Box (-b - d) / (2 \textbf{ x } a)$

Print
x_1, x_2

STOP

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Example 10

- Write an algorithm that reads two values, determines the largest value and prints the largest value with an identifying message.

Example 10

ALGORITHM
Step 1: *Input* VALUE1, VALUE2
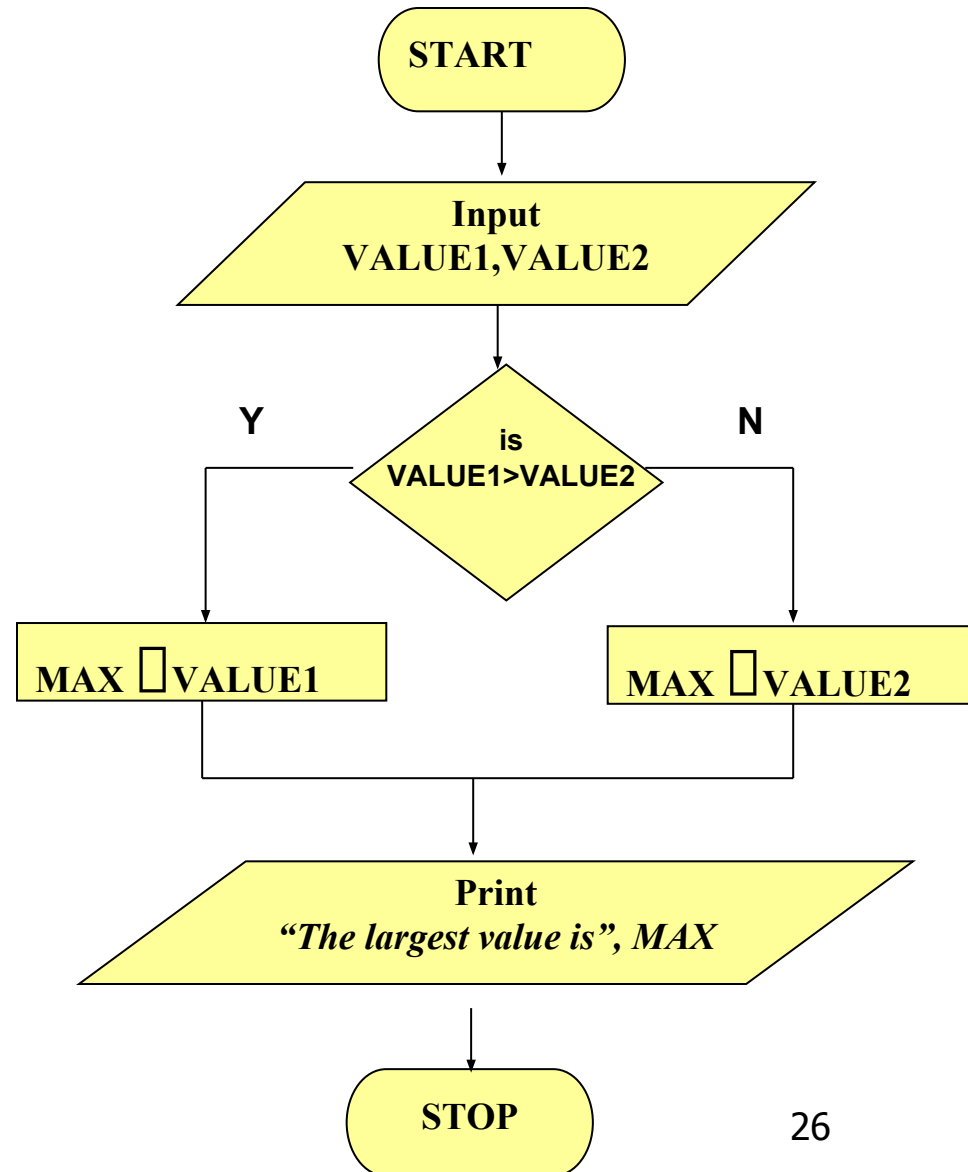Step 2: *if (*VALUE1 > VALUE2)
  then
  MAX ⬜VALUE1
  else
  MAX ⬜VALUE2
  endif
Step 3: *Print "The largest value is", MAX*

START

Input
VALUE1,VALUE2

is
VALUE1>VALUE2

Y   N

MAX ⬜VALUE1   MAX ⬜VALUE2

Print
"The largest value is", MAX

STOP

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Example 11

Write and algorithm and draw a flowchart to

a) read an employee name (NAME), overtime hours worked (OVERTIME), hours absent (ABSENT) and

b) determine the bonus payment (PAYMENT).

Example 11

Bonus Schedule	
OVERTIME – (2/3)*ABSENT	Bonus Paid
>40 hours >30 but ≤ 40 hours >20 but ≤ 30 hours >10 but ≤ 20 hours ≤ 10 hours	$50 $40 $30 $20 $10

Step 1: *Input* NAME,OVERTIME,ABSENT
Step 2: *if* (OVERTIME–(2/3)*ABSENT > 40) *then*
         PAYMENT ⟵50
    *else if (*OVERTIME–(2/3)*ABSENT > 30) *then*
         PAYMENT ⟵40
    *else if (*OVERTIME–(2/3)*ABSENT > 20) *then*
         PAYMENT ⟵30
    *else if (*OVERTIME–(2/3)*ABSENT > 10) *then*
         PAYMENT ⟵20
    else
         PAYMENT ⟵10
    endif
Step 3: *Print* "Bonus for", NAME "is $", PAYMENT

Example 11

- **Flowchart: Draw the flowchart of the above algorithm?**

Example 12

Express an algorithm to get two numbers from the user (dividend and divisor), testing to make sure that the divisor number is not zero, and displaying their quotient using a *flowchart*.

Example 12 Answer

- **Step 1** – Declare variables – dividend, divisor, quotient
- **Step 2** – Prompt user to get dividend
- **Step 3** – Store values in dividend variable
- **Step 4** – Prompt user to get divisor
- **Step 5** – Store value in divisor variable
- **Step 6** – Display dividend and divisor
- **Step 7 -** Loop

  Selection: If divisor is equal to zero

  Display error message, "divisor must be non-zero" and

- go back to step 4
- **Step 8 -** Calculate quotient as dividend/divisor
- **Step 9 -** Display quotient

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