

Branching and Loops

Ayisigi B. Sevdik

18.11.2004
Bilkent University

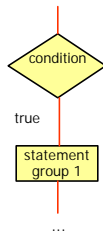
Branches

- if statements
- else statements
- elseif statements
- if-elseif-else statements
- switch statements

2

if statements

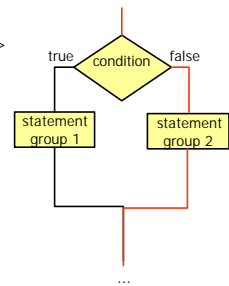
- if (condition)
 <statement group 1>
end



3

else statements

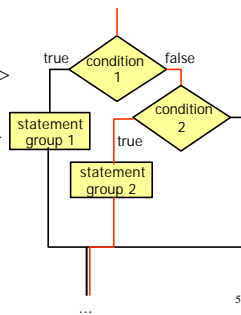
- if (condition)
 <statement group 1>
else
 <statement group 2>
end
...



4

elseif statements

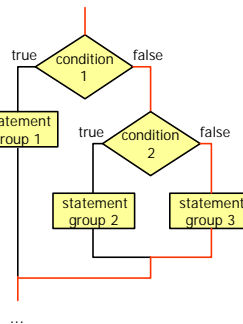
- if (condition 1)
 <statement group 1>
elseif (condition 2)
 <statement group 2>
end
...



5

if-elseif-else statements

- if (condition 1),
 statement 1
 statement 2
 ... } statement group 1
- elseif (condition 2),
 statement 1
 statement 2
 ... } statement group 2
- else
 statement 1
 statement 2
 ... } statement group 3
- end



6

Example: rock-paper-scissors game

```
% Generate computer's choice
a=ceil(randi(1)^3);

% Get user input
user=input('enter 1 for rock in enter 2 for paper in enter 3 for scissors');

% Display your choice
if a==1;
    disp('I chose rock');
elseif a==2;
    disp('I chose paper');
else
    disp('I chose scissors');
end

% Display user's choice
if user==1;
    disp('You chose rock');
elseif user==2;
    disp('You chose paper');
else
    disp('You chose scissors');
end

win=[0 2 1; 1 0 2; 2 1 0];
result=win(user,a);

% Display result
if result==0
    disp('Stale for draw!');
elseif result==1
    disp('You win!');
else
    disp('You are loser!');
end
```

7

switch statements

```
switch ( expression ),
case {value set 1},
    <statement group 1>
case {value set 2},
    <statement group 2>
otherwise,
    <statement group 3>
end
```

Example:

```
% Remember the rock-paper-scissors game...
switch ( user ),
case {1},
    fprintf(' You chose rock');
case {2},
    fprintf(' You chose paper');
case {3},
    fprintf(' You chose scissors');
otherwise,
    fprintf(' Enter 1 for rock, 2 for paper, 3 for scissors. ');
end
```

8

Example: rock-paper-scissors game

```
% Generate computer's choice
a=ceil(randi(1)^3);

% Get user input
user=input('enter 1 for rock in enter 2 for paper in enter 3 for scissors');

% Display your choice
switch(a)
case{1}
    disp('I chose rock ');
case{2}
    disp('I chose paper');
case{3}
    disp('I chose scissors');
end

% Display user's choice
switch (user)
case{1}
    disp('You chose rock ');
case{2}
    disp('You chose paper');
otherwise
    disp('You chose scissors');
end

win=[0 2 1; 1 0 2; 2 1 0];
result=win(user,a);

% Display result
if result==0
    disp('Stale for draw!');
elseif result==1
    disp('You win!');
else
    disp('You are loser!');
end
```

9

Loops

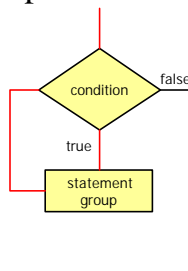
- While loop
- For loop
- Break/ continue statements



10

while loops

- while(condition)
 - <statement group>
 - ...
 - end



11

Example: rock-paper-scissors game

```
answer='y';
while answer=='y'
% Generate computer's choice
a=ceil(randi(1)^3);

% Get user input
user=input('enter 1 for rock in enter 2 for paper in enter 3 for scissors');

% Check for erroneous input
while user==1 && user==2 && user==3
    user=input('enter 1 for rock in enter 2 for paper in enter 3 for scissors');
end

% Display your choice
switch(a)
case{1}
    disp('I chose rock ');
case{2}
    disp('I chose paper');
case{3}
    disp('I chose scissors');
end

win=[0 2 1; 1 0 2; 2 1 0];
result=win(user,a);

% Display result
if result==0
    disp('Stale for draw !');
elseif result==1
    disp('You win!');
else
    disp('You are loser!');
end

answer=input('do you wanto continue,y? ');
end
```

12

for loops

- for index = expression, → Generally in the form of
`<statement 1>`
`<statement 2>`
`...`
`end`
 first:inc:last

13

Example: factorial

```
% Get input from user.
n=input('Please enter n: ');

% Give error if input is erroneous.
while (n<0)
    n=input('Invalid entry . Please enter a nonnegative number: ');
end

% Calculate the factorial of a number n.
if (n == 0)
    f=1;
elseif (n==1)
    f=n;
else
    f=1;
    for ii=2:n
        f=f*ii;
    end
end

% Display output.
fprintf('%d! = %d', n, f);
```

14

Example: max value index

```
% Find the index of the largest number in a vector.
% Consider the case where the vector has more than
% 1 occurrences of its max value.
```

```
x= input('Enter a vector: ');
max_value = x(1);
max_index = 1;
k = 1;
```

```
% Find max value of x
for ii = 2:length(x),
    if (x(ii)>max_value),
        max_value = x(ii);
    end
end
```

max_value = max(x)

```
% find max values/indices
for ii = 1:length(x),
    if (x(ii)==max_value),
        max_index(k)= ii;
        k = k+1;
    end
end
```

```
fprintf('Max value is %d\n',max_value);
fprintf('It is found at %d\n',max_index);
```

15

break & continue statements

- **break** statement terminates the execution of a loop and passes the control to the next statement after the end of the loop.
- **continue** statement terminates the current pass through the loop and returns control to the top of the loop.

16

Example: search for n

```
% Get inputs from the user.
array=input('Please enter the array to search:');
n=input('Please enter the number to be searched:');
```

```
% Get size of the array.
[r c]=size(array);
```

```
% Search for n in the array.
for ii=1:r
    fprintf('row %d\n',ii);
    for jj=1:c
        fprintf('column %d\n',jj);
        if(array(ii,j)==n)
            fprintf('%d found at row %d, column %d\n',n,ii,j);
            break;
        end
    end
end
fprintf('ii is %d, jj is %d\n',ii,jj);
```

Output:

```
Please enter the array to search :[2 4 5; 6 13 2; 5 3 11]
Please enter the number to be searched :13

row 1
column 1
column 2
column 3
row 2
column 1
column 2
13 found at row 2, column 2
row 3
column 1
column 2
column 3
ii is 3, jj is 3
```

17

Example: search for n

```
% Get inputs from the user.
array=input('Please enter the array to search:');
n=input('Please enter the number to be searched:');
```

```
% Get size of the array.
[r c]=size(array);
```

```
% Search for n in the array.
for ii=1:r
    fprintf('row %d\n',ii);
    for jj=1:c
        fprintf('column %d\n',jj);
        if(array(ii,j)==n)
            fprintf('%d found at row %d, column %d\n',n,ii,j);
            continue;
        end
    end
end
fprintf('ii is %d, jj is %d\n',ii,jj);
```

Output:

```
Please enter the array to search :[2 4 5; 6 13 2; 5 3 11]
Please enter the number to be searched :13

row 1
column 1
column 2
column 3
row 2
column 1
column 2
13 found at row 2, column 2
row 3
column 1
column 2
column 3
ii is 3, jj is 3
```

18

more examples...



19

Example: set difference

```
% Find the difference between two sets
A=input('Enter the first set: ');
B=input('Enter the second set: ');

found=0;
diff=[];

% Find difference
for i=1:length(A)
    found=0;
    for j=1:length(B)
        % If same, break
        if(A(i)==B(j))
            found=1;
            break;
        end
    end

    % If not found in B, add to diff array.
    if (~found)
        diff=[diff A(i)];
    end
end

% Display difference array.
fprintf('Their difference is: ');
for i=1:length(diff)
    fprintf('%d ',diff(i));
end

Output:
Enter the first set: [1 3 2 8 0 6]
Enter the second set: [2 4 0 3 5]
Their difference is 1 8 6
```

20

Example: student grades

```
% Get inputs from user.
grades=input('Enter a grades matrix: ');
weights=input('Enter a weights vector: ');
[r c]=size(grades);
multi=zeros(c,c);
overall=zeros(r,1);
pass=0;
fail=0;
max=1;

% Divide weights by 100 to obtain percent weights
weights=weights/100;

% Loop for each student
for ii=1:r
    % Multiply grades and weights
    multi(ii,:)=grades(ii,:).*weights;
    % Add each weighted grade to obtain overall grade
    for j=1:c
        overall(ii)=overall(ii)+multi(ii,j);
    end

    % Print out overall grade
    fprintf('Overall grade of student %d: %2f\n',ii,overall(ii));

    % Calculate pass/fail numbers
    if(overall(ii)>=65)
        pass=pass+1;
    else
        fail=fail+1;
    end

    % Highest grade student
    if(overall(max)<overall(ii))
        max=ii;
    end
end

% Print out number of passing / failing students.
fprintf('The number of passing students is: %d\n',pass);
fprintf('The number of failing students is: %d\n',fail);

% Print out who got the highest overall grade.
for ii=1:r
    if(overall(ii)==overall(max))
        fprintf('Student %d got the highest overall grade!\n',ii);
    end
end
```

21

Example: student grades

```
Output:
Enter a grades matrix [80 70 90 60 50 85 40 100 30 20 90 60 75 50 40 60 80 95 70 60; 100 95 90 80 80; 70 65 85 45 75]
Enter a weights vector: [25 10 10 25 30]
Overall grade of student 1: 66.00
Overall grade of student 2: 48.75
Overall grade of student 3: 60.50
Overall grade of student 4: 68.00
Overall grade of student 5: 87.50
Overall grade of student 6: 66.25
The number of passing students is: 4
The number of failing students is: 2
Student 5 got the highest overall grade.
```

22

Some Remarks

- Use **indentation** to improve the readability of your code.
- Always **comment** your code so others can understand it.
- **Test & debug** your code before getting graded/handing it in.
 - **Test:** Check that your code is running properly. Enter different values to see that it does.
 - **Debug:** If your code is not running correctly, add some statements to see where you have a problem.
 - Add `disp` or `fprintf` statements to see if your program enters a loop, or to see the value of a variable at some point, etc.
- Always hand in your **own work!!!**

23