Branching and Loops

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Branches

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

### if statements

- **if** (condition)
  - <statement group 1>
- **end**

### else statements

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

### elseif statements

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

### if-elseif-else statements

- **if** (condition 1),
  - statement 1
  - statement 2
- **elseif** (condition 2),
  - statement 1
  - statement 2
- **else**
  - statement 1
  - statement 2
- **end**
Example: rock-paper-scissors game

% Generate computer's choice
a = ceil(rand(1) * 3);

% Get user input
user = input('enter 1 for rock
enter 2 for paper
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

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

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

switch
    case {1}
        disp('You chose rock');
    case {2}
        disp('You chose paper');
    case {3}
        disp('You chose scissors');
    otherwise
        disp('Enter 1 for rock, 2 for paper, 3 for scissors.');
end

Example: rock-paper-scissors game

display loops

• while loop

  • while (condition)
  
    <statement group>

  end

while loops

Loops

• While loop

• For loop

• Break/continue statements

Example: rock-paper-scissors game

while loops

• while (condition)

  <statement group>

end

Example: rock-paper-scissors game

switch statements

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

Example: rock-paper-scissors game
**for loops**

- **for** index = expression, Generally in the form of first:inc:last

  ... end

**Example: factorial**

```matlab
% 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);
```

**Example: max value index**

```matlab
% Find the index of the largest number in a vector.
% Consider the case where the vector has more than 1 occurences of its max value.
x = input ('Enter a vector: ');% Find max value of x
max_value = x(1);
max_index = [];
k = 1;
for ii = 2:length(x),
    if (x(ii)>=max_value),
        max_value = x(ii);
    end
end
% 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
',max_value);
fprintf('It is found at %d
',max_index);
```

**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.

**Example: search for n**

```matlab
% 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
',ii);
    for jj=1:c
        fprintf('column %d
',jj);
        if(array(ii,jj)==n)
            fprintf('%d found at row %d, column %d
',n, ii,jj);
            break;
        end
    end
end
fprintf('ii is %d, jj is %d
',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
```
more examples…

Example: set difference

```matlab
% Find the difference (set difference) sets.
A=input('Enter the first set: ');
B=input('Enter the second set: ');
found=0;
diff=[];
% Find difference.
for ii=1:length(A)
    found=0;
    for jj=1:length(B)
        % If same, break.
        if(A(ii)==B(jj))
            found=1;
            break;
        end
    end
    % If not found in B add to diff array.
    if (~found)
        diff=[diff A(ii)];
    end
end
% Display difference array.
fprintf('Their difference is ');
for ii=1:length(diff)
    fprintf('%d ',diff(ii));
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

Example: student grades

```matlab
% Get inputs from user.
grades=input('Enter a grades matrix: ');
weights=input('Enter a weights vector: ');
[r c]=size(grades);
multip=zeros(r,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 grade and weights
    multip(ii,:)=grades(ii,:).*weights;
    % Add each weighted grade to obtain overall grade
    for jj=1:c
        overall(ii)=overall(ii)+multip(ii,jj);
    end
end
%print out overall grade
fprintf('Overall grade of student %d: %.2f
',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
% Print out number of passing / failing students
fprintf('The number of passing students is: %d
',pass);
fprintf('The number of failing students is: %d
',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.
',ii);
    end
end
```

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.

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!!!