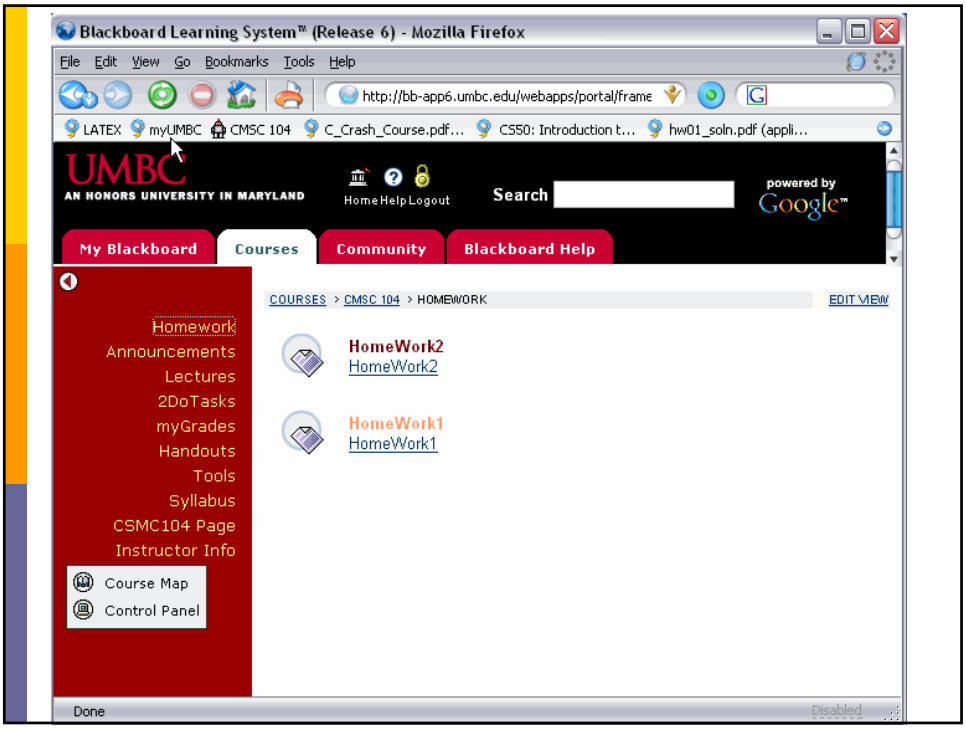
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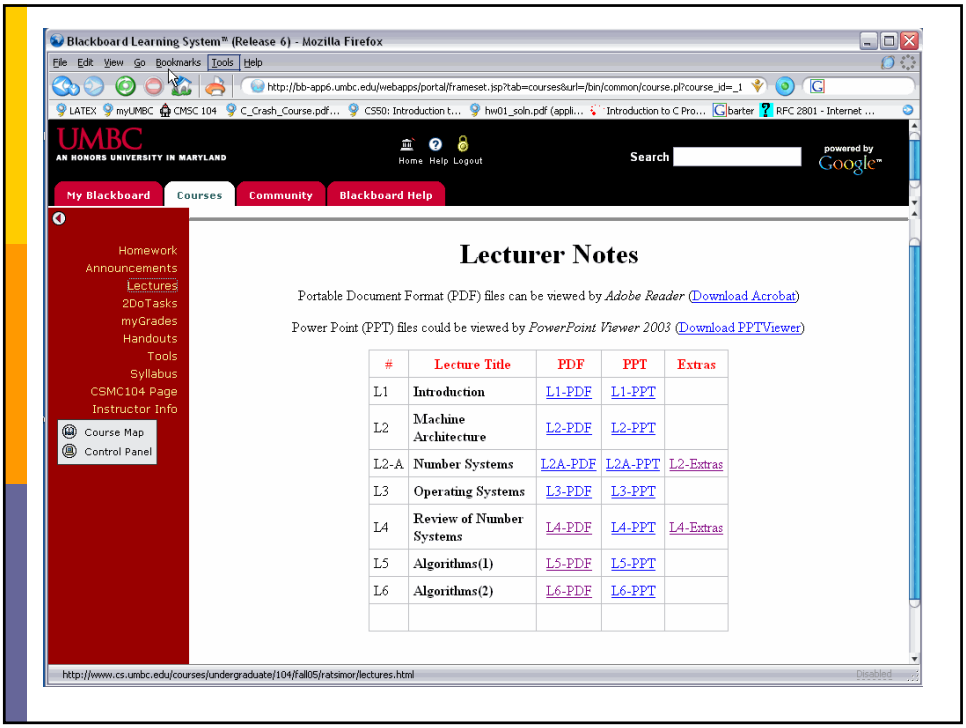
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L2 | Machine Architecture | L2-PDF | L2-PPT |
L2-A | Number Systems | L2A-PDF | L2A-PPT | L2-Extras
L3 | Operating Systems | L3-PDF | L3-PPT |
L4 | Review of Number Systems | L4-PDF | L4-PPT | L4-Extras
L5 | Algorithms(1) | L5-PDF | L5-PPT |
L6 | Algorithms(2) | L6-PDF | L6-PPT |
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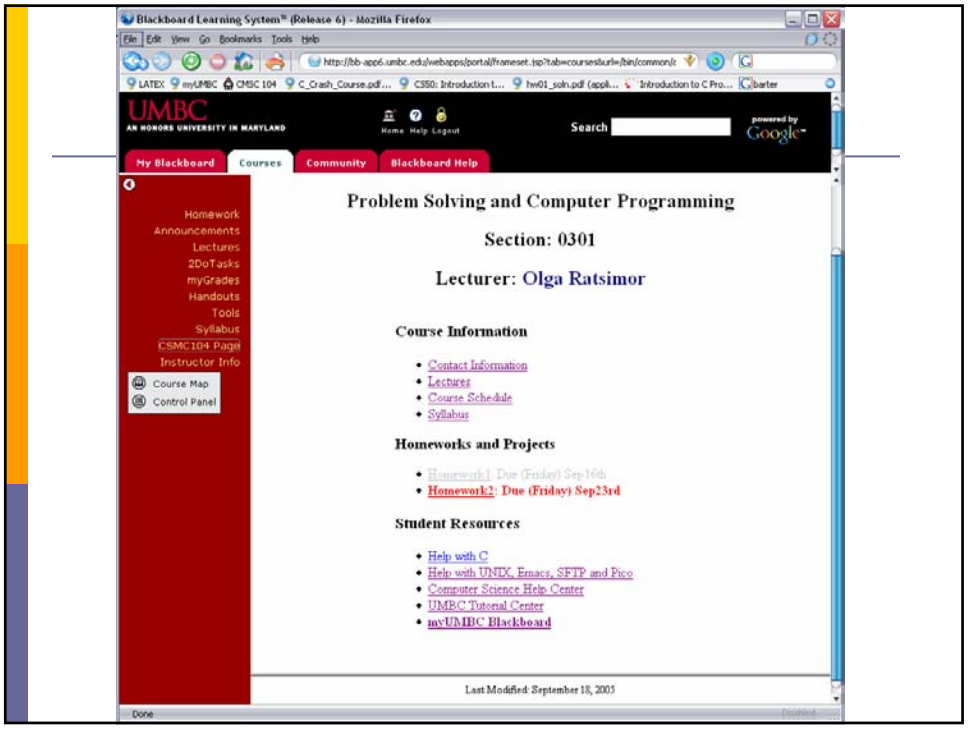

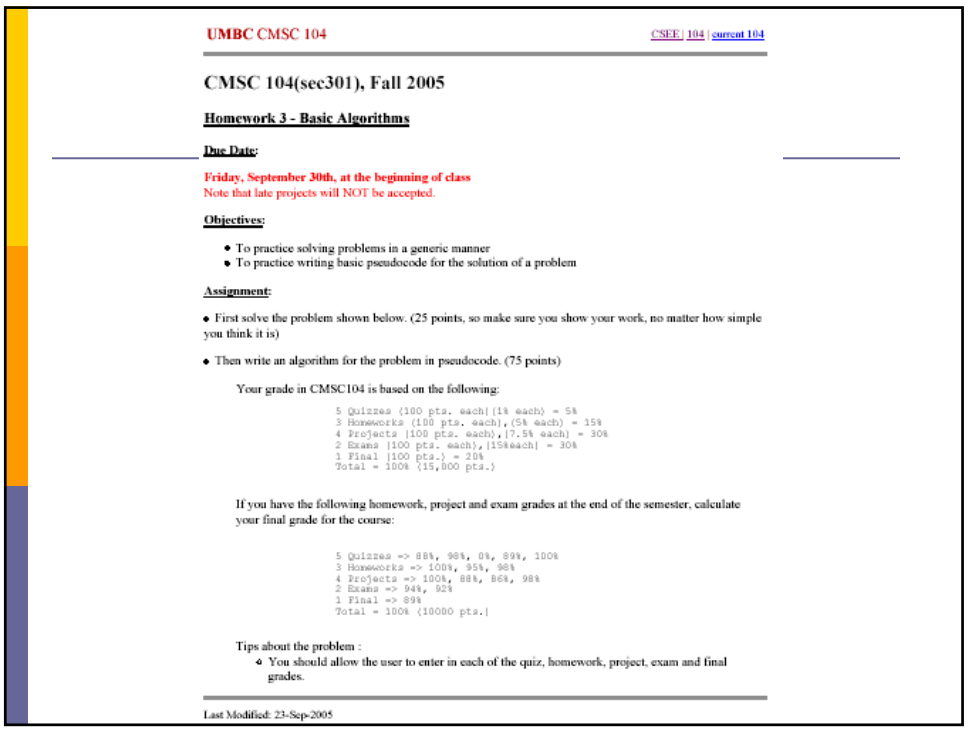

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CMSC 104(sec301), Fall 2005

Homework 3 - Basic Algorithms

Due Date:

Friday, September 30th, at the beginning of class
Note that late projects will NOT be accepted.

Objectives:

- To practice solving problems in a generic manner
- To practice writing basic pseudocode for the solution of a problem

Assignment:

- First solve the problem shown below. (25 points, so make sure you show your work, no matter how simple you think it is)
- Then write an algorithm for the problem in pseudocode. (75 points)

Your grade in CMSC104 is based on the following:

```
5 Quizzes (100 pts. each)(1% each) = 5%
3 Homeworks (100 pts. each),(5% each) = 15%
4 Projects (100 pts. each),(7.5% each) = 30%
2 Exams (100 pts. each),(15%each) = 30%
1 Final (100 pts.) = 20%
Total = 100% (15,000 pts.)
```

If you have the following homework, project and exam grades at the end of the semester, calculate your final grade for the course:

```
5 Quizzes => 88%, 98%, 0%, 89%, 100%
3 Homeworks => 100%, 95%, 98%
4 Projects => 100%, 88%, 86%, 98%
2 Exams => 94%, 92%
1 Final => 89%
Total = 100% (10000 pts.)
```

Tips about the problem :

- You should allow the user to enter in each of the quiz, homework, project, exam and final grades.

Last Modified: 23-Sep-2005

Quiz1 Question

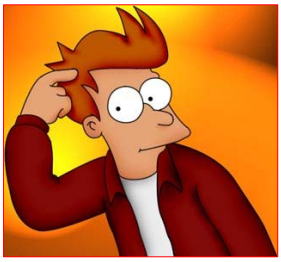
- Add Binary Numbers
  a) 1 0 1 0 1 0
  b) 0 1 0 0 1 1
  c) 0 1 0 0 0 1
  d) 0 1 0 1 1 1
  e) none

1 0 1 1
+1 0 0 0
1 0 0 1 1

001011
001000
010011

Quiz1 question

- What is the largest decimal number you can represent using 3 bits ?
  a) 7
  b) 8
  c) 9
  d) 15
  e) 16
  f) 17
  g) None



- What is a bit?
  - A **bit** is a single **binary digit** (a 1 or 0).
  - A **byte** is 8 bits

Algorithms 3

Pseudocode,
If, If-Else, While, For

Control Structures

Any problem can be solved using only three logical **control structures**:

- **Sequence**
- **Selection**
- **Repetition**

While & For

Euclid's Algorithm

Problem: Find the largest positive integer that divides evenly into two given positive integers (i.e., the **greatest common divisor**).

Algorithm:

1. Assign M and N the values of the larger and smaller of the two positive integers, respectively.
2. Divide M by N and call the remainder R.
3. If R is not 0, then assign M the value of N, assign N the value of R, and return to Step 2. Otherwise, the greatest common divisor is the value currently assigned to N.

Finding the GCD of 24 and 9

M	N	R
24	9	6
9	6	3
6	3	0

So, 3 is the GCD of 24 and 9.

http://en.wikipedia.org/wiki/Remainder
http://en.wikipedia.org/wiki/Euclidean_algorithm

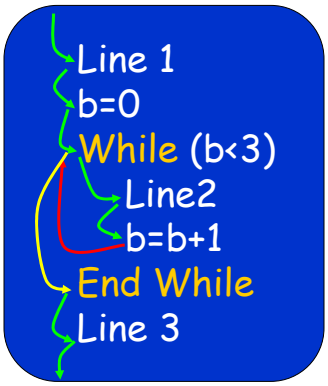
GCD Pseudocode

M	N	R
24	9	6
9	6	3
6	3	0

Display "Enter the larger number: "
Read <numberX>
Display "Enter the smaller number: "
Read <numberY>
<numberR> = <numberX> modulo <numberY>
While (<Remainder> **>** 0**)**
    <numberX> = <numberY>
    <numberY> = <Remainder>
    <Remainder> = <numberX> modulo <numberY>
EndWhile
Display "GCD ="<numberY>

http://en.wikipedia.org/wiki/Remainder
http://en.wikipedia.org/wiki/Euclidean_algorithm

While Loops



- If boolean expression is True the lines inside the while statement are executed.
- If boolean expression is False lines are skipped

Line1
b=0
Line2
b=b+1 (b is now = 1)
Line2
b=b+1 (b is now = 2)
Line2
b=b+1(b is now = 3)
Line3

For loop

```
For (<age> = 5 To 16)
    Display "You are “, <age>
    Display "Go to school."
EndFor
Display "School's out!"
```

This would produce the following output :

You are 5.
Go to school.
You are 6.
Go to school. ...
You are 15.
Go to school.
You are 16.
Go to school.
School's out!

Compute the average of ten numbers

<Total> =0

<average> = 0

For (1 to 10)

    Display “Enter the number: ”

    Read <number>

    <Total> = <Total> + <number>

EndFor

<average> = <Total> / 10

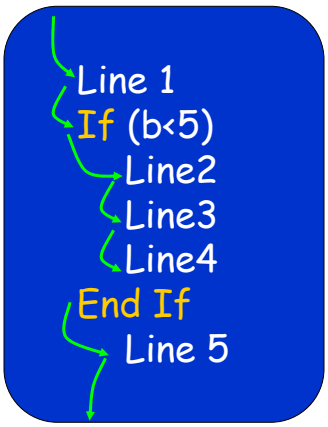
Display “average of the 10 numbers is = ”, <average>

If Statements

Bank

Display “Enter exisitng balance: “
Read <balance>
Display “Enter the deposit amount: “
Read <depositAmount>
<balance> = <balance> + <depositAmount>
If (<balance> < 500)
    <monthlyInterest> = <balance> * .02
    Display “monthly Interest is”, <monthlyInterest>
    <balance> = <balance> + <monthlyInterest>
End If
Display “New balance is: “, <balance>

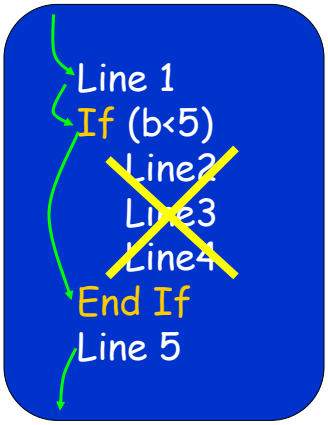
If Statements



If Boolean expression is True the lines following the if statement are executed
Lines following else statement are skipped

If b = 2 the lines that will be executed are:
Line1
Line2
Line3
Line4
Line5

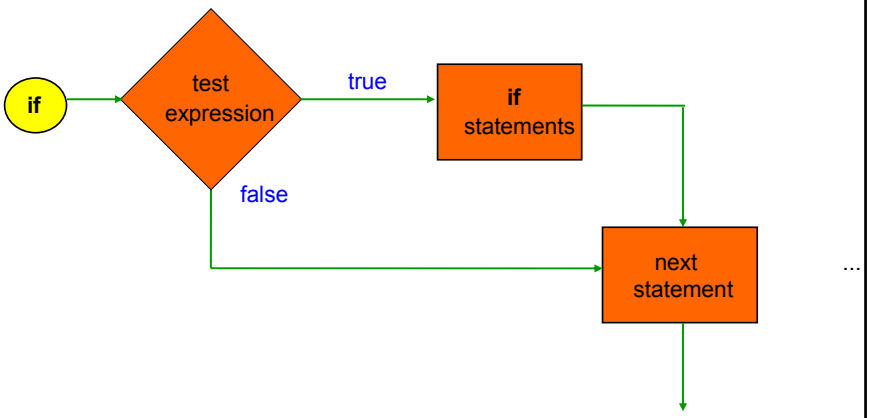
If Statements



If Boolean expression is True the lines following the if statement are executed
Lines following else statement are skipped

If b = 7 the lines that will be executed are:
Line1
Line5

The Flow of the if Statement



Cookie Jar Problem

Problem:

Mom had just filled the cookie jar when the 3 children went to bed.

That night one child woke up, ate half of the cookies and went back to bed.

Later, the second child woke up, ate half of the remaining cookies, and went back to bed.

Still later, the third child woke up, ate half of the remaining cookies, leaving 3 cookies in the jar.

How many cookies were in the jar to begin with?

Original Pseudocode

Display "Enter the number of children: "
Read <number of children>
Display "Enter the number of cookies remaining"
Read <cookies remaining>
<original cookies> = <cookies remaining>
While (<number of children> > 0)
    <original cookies> = <original cookies> x 2
    <number of children> = <number of children> - 1
End_While
Display "Original number of cookies = ", <original cookies>

What will user see

Enter the number of children: 3
Enter the number of cookies remaining: 3
Original number of cookies = 24

Cookie Jar Problem

- What if the Cookie Jar was not touched
  - Number of kids is 0
- What if we wanted our Pseudocode to emphasize that the cookie jar was not touched.
- We need to add an extra **Display** statement. But it should be executed only if number of kids is 0.

Pseudocode: Number of Children was 0

Display "Enter the number of children: " 0
Read <number of children>
Display "Enter the number of cookies remaining:
Read <cookies remaining>
<original cookies> = <cookies remaining>
If (<number of children> ==0**)**
    Display "Cookie Jar was untouched"
EndIf
While (<number of children> > 0)
    <original cookies> = <original cookies> X 2
    <number of children> = <number of children> - 1
End_While
Display "Original number of cookies = ", <original cookies>

What will user see if He/She enters 0

Enter the number of children: 0
Enter the number of cookies remaining: 10
Cookie Jar was untouched
Original number of cookies = 10

What will user see if He/She enters 1

Enter the number of children: 1 

Enter the number of cookies remaining: 7

Original number of cookies = 14

Pseudocode: Number of Children was 0

Display "Enter the number of children: " 1 

Read <number of children>

Display "Enter the number of cookies remaining:

Read <cookies remaining>

<original cookies> = <cookies remaining>

If (<number of children> ==0**)**

    Display "Cookie Jar was untouched"

EndIf

While (<number of children> > 0)

    <original cookies> = <original cookies> x 2

    <number of children> = <number of children> - 1

End_While

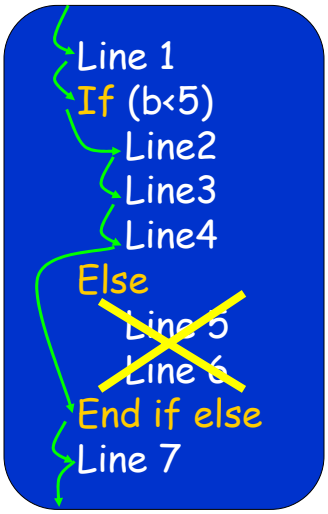
Display "Original number of cookies = ", <original cookies>

If-Else

Compute a Min

Display “Enter x: “
Read <numberX>
Display “Enter y: “
Read <numberY>
If (<numberX> <= <numberY>)
    Display “ Y is grater or equal to X”
Else
    Display “ X is grater then Y”
EndIfElse

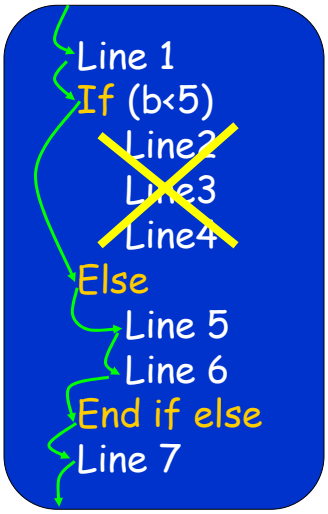
If Else Statements



If Boolean expression is True the lines following the if statement are executed
Lines following else statement are skipped

If b = 2 the lines that will be executed are:
Line1
Line2
Line3
Line4
Line7

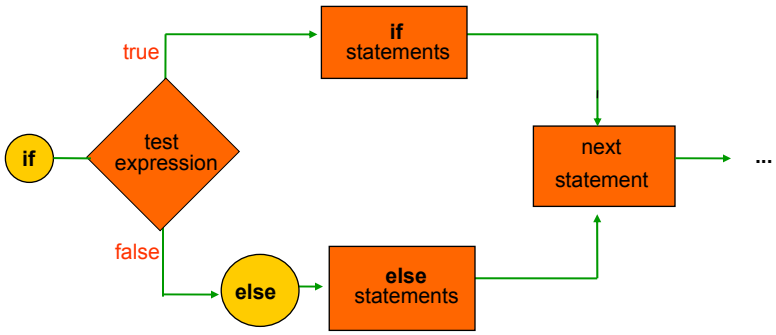
If Else Statements



If Boolean expression is True the lines following the if statement are executed
Lines following else statement are skipped

If b = 7 the lines that will be executed are:
Line1
Line5
Line6
Line7

The Flow of the if/else Statement



Cookie Jar Problem- unsolvable

Problem:

Mom had just filled the cookie jar when the 3 children went to bed.

That night one child woke up, ate half of the cookies and went back to bed.

Later, the second child woke up, ate half of the remaining cookies, and went back to bed.

The third child woke up, ate the remaining cookies the jar.

How many cookies were in the jar to begin with?

Original Pseudocode

Display “Enter the number of children: “
Read <number of children>

Display “Enter the number of cookies remaining”
Read <cookies remaining>
<original cookies> = <cookies remaining>
While (<number of children> > 0)
    <original cookies> = <original cookies> x 2
    <number of children> = <number of children> - 1
End_While
Display “Original number of cookies = “, <original cookies>

if else Statement in Cookie Jar Problem

Display “Enter the number of children: “
Read <number of children>

Display “Enter the number of cookies remaining: “
Read <cookies remaining>
If (<cookies remaining>==0**)**
    Display “The mystery can not be solved”
Else
    <original cookies> = <cookies remaining>
    While (<number of children> > 0**)**
        <original cookies> = <original cookies> x 2
        <number of children> = <number of children> - 1
    End_While
    Display “Original number of cookies = “, <original cookies>
EndIfElse
Display “Good Bye”

What will user see if He/She enters 1

Enter the number of children: 3 

Enter the number of cookies remaining: 3

Original number of cookies = 24

Good Bye

What will user see if He/She enters 1

Enter the number of children: 3 

Enter the number of cookies remaining: 0

The mystery can not be solved

Good Bye

HW2

- Logic must be correct
- Style
  - Do not write C Code (no }, no ;)
  - Use Key words to Display and Read
  - Need to have variables in <>
  - Need to have indentation for if, if-else, for, while