Computers in Engineering COMP 208

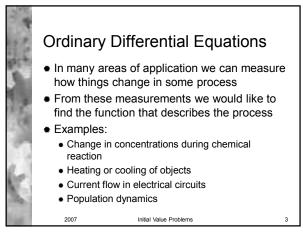
Initial Value Problems Michael A. Hawker

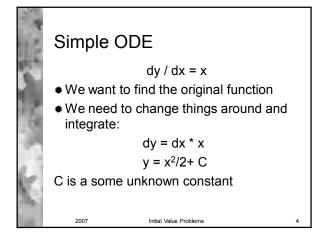
Differential Equations

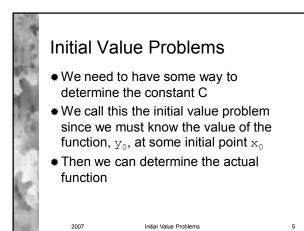
2007

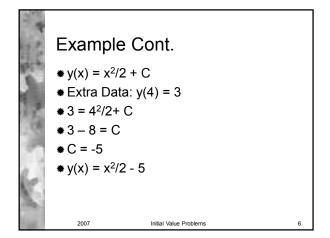
- Differential Equations are based on an unknown function involving one or more variables
- An Ordinary Differential Equation is a DE that depends on one unknown variable and is usually in the form F(x, f(x), f'(x), ..., fⁿ(x)) = 0

Initial Value Problems







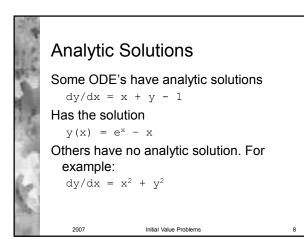


ODE's

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- We let y(x) be the function we would like to study; however, we are only able to observe the rate of growth of the function
- * This leads to equations of the form dy/dx = f(x,y)
- As we have just seen we can formulate a solution

Initial Value Problems



What do we do? If we can't find a closed form of the function We turn back to numerical methods to approximate the solution

The Euler Method

- * We "grow" the function from the starting value one step at a time
- Think of the dy/dx in terms of discrete steps, delta_y and delta_x
- Then the derivative approximates the ratio of these two values for small vaues of delta_x

Initial Value Problems

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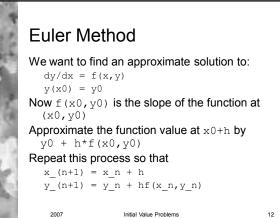
The Euler Method

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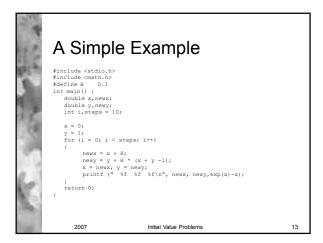
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- Multipling dy/dx by delta_x gives an approximate value for delta_y
- The Euler method increments the independent variable by one stepsize, delta x, at a time
- Using the derivative, we approximate delta_y and then the value of the function at the next step

Initial Value Problems



Initial Value Problems

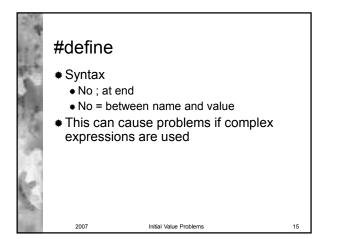


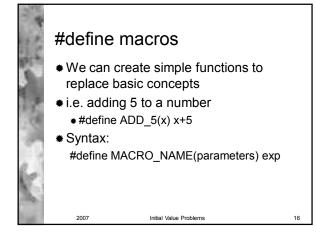
#define

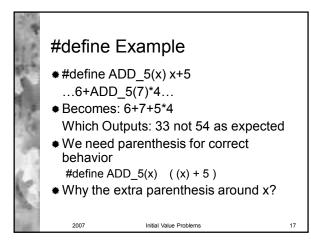
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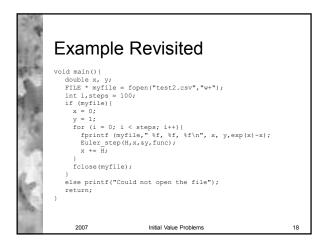
- * After the #include commands, we can also define names using #define
- In the program, the name is replaced by the expression
- Note that the name is not a variable (there is no memory location for it)
- The name is just an alias for the value
 i.e. Find and Replace

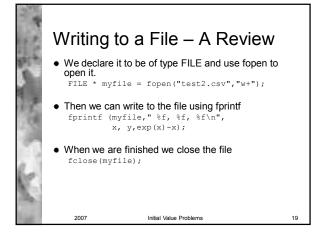
Initial Value Problems

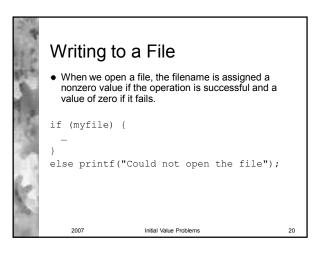


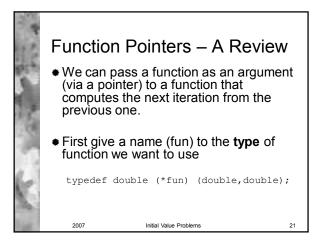


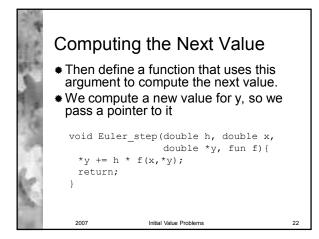


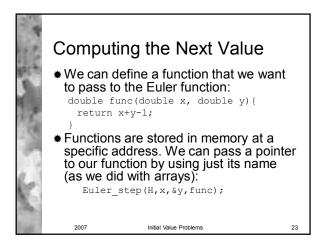


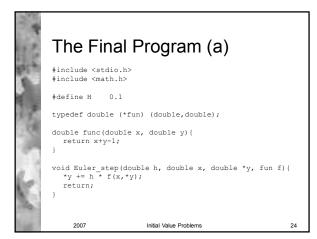












うちて	The Final Program (b)		
Same .	<pre>int i,steps = 1 if (myfile) { x = 0; y = for (i = 0, fprintf</pre>	l; ; i < steps; i++){ (myfile," %f, %f\n", x, y,exp(x)-x); p(H,x,&y,func);	
5	<pre>else printf("Co return 0; }</pre>	ould not open the file");	
1.000	2007	Initial Value Problems	25

