1. What can be computed?

2. Two approaches
   a) a language (Bare Bones)
   b) a machine (Turing Machine)
   c) theoretical and conceptual (i.e. not practical)
   d) Powerful ... used to prove mathematically what is possible.
   e) We’ll try to “get the flavor” of this type of thinking.

3. Bare Bones ... a language
   a) Data Types ... a string of 0’s and 1’s
   b) Variables letters of the alphabet or a string of letters
   c) Primitives
      - CLEAR X;
      - INCR X;
      - DECR X;
   d) Control
      - WHILE X DO; ... END;
      - NOT;
   e) Syntax ... a semicolon after every statement.
   f) Example program
A “Bare Bones” Multiplication Program

clear Z;
while X not 0 do;
    clear W;
    while Y not 0 do;
        incr Z;
        incr W;
        incr Y;
    end;
    while W not 0 do;
        incr Y;
        decr W;
    end;
    decr X;
end;
end;
4. Turing Machine
   a) The “tape” (T)
   b) The read/write head

5. States
   a) Concept of a state
   b) Concept of a change of state

6. Example ... a Turing Machine that can increment a number on the tape. (T)

7. Church - Turing Thesis
   • Bare Bones and the Turing Machine are equivalent

8. The Halting Problem