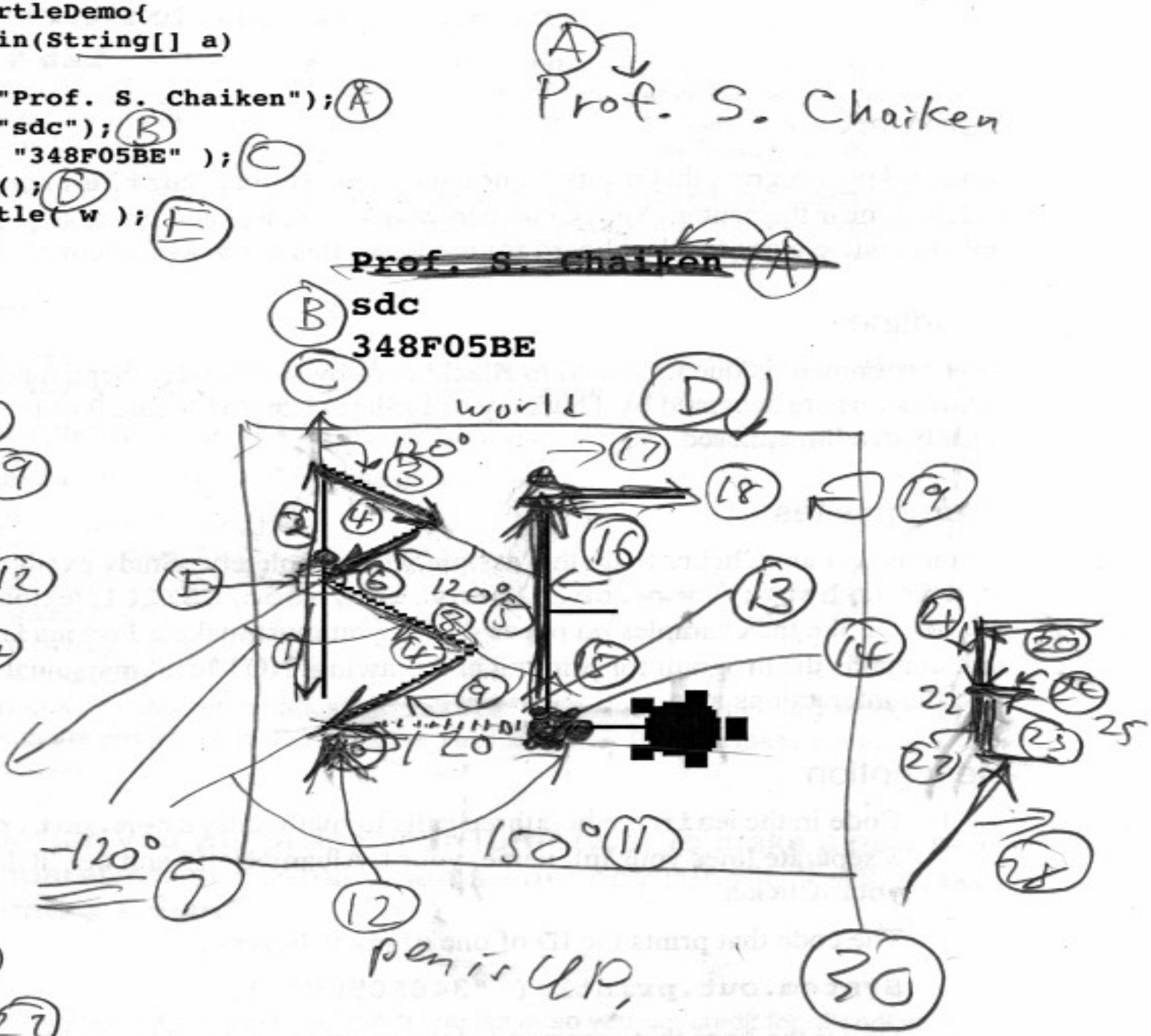
Lecture 03
Learning to Program

- One of the best (maybe the best) way to learn to program starts with downloading source files of software.
- But: It is NOT just compiling and playing with the software.
- It is: Figure out how the program works LINE BY LINE.
- See my scribblings on the next slide!

Lecture 03

- End of Lecture 02: Sketch in NUMBERED STEPS how the Turtle draws the B on Project 1 assignment sheet.
- Want to see that again?

```
public class PrintAndTurtleDemo{
  public static void main(String[] a)
  {
    System.out.println("Prof. S. Chaiken");
    System.out.println("sdc");
    System.out.println( "348F05BE" );
    World w = new World();
    Turtle tu = new Turtle( w );
    tu.forward(-30);
    tu.forward(60);
    tu.turn(120);
    tu.forward(30);
    tu.turn(120);
    tu.forward(30);
    tu.turn(-120);
    tu.forward(40);
    tu.turn(120);
    tu.forward(40);
    tu.turn(-150);
    tu.penUp();
    tu.forward(50);
    tu.penDown();
    tu.turn(-90);
    tu.forward(60);
    tu.turn(90);
    tu.forward(30);
    tu.turn(180);
    tu.forward(30);
    tu.turn(-90);
    tu.forward(30);
    tu.turn(-90);
    tu.forward(15);
    tu.turn(180);
    tu.forward(15);
    tu.turn(-90);
    tu.forward(30);
    tu.turn(-90);
    tu.forward(30);
  }
}
```



I invented a visual language for the path of a Turtle when the Turtle's pen is up (so it doesn't draw anything):
DOTTED LINE

Lecture 03

- Somebody attempted to draw a golf club and go back to where he started:

  tu.forward(100); tu.turn(30); tu.forward(20);
  tu.forward(-100); tu.turn(-30); tu.forward(-20);

- His idea was do the reverse of each step.

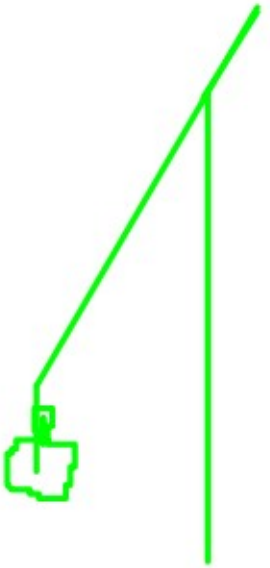
```
tu.forward(100);
tu.turn(30);
tu.forward(20);
tu.forward(-100);
tu.turn(-30);
tu.forward(-20);
```

Sketch the action on paper!!!

Do it now! Really!!

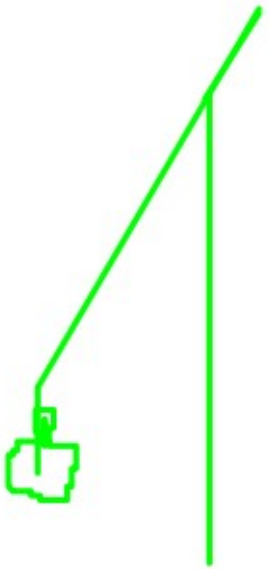
Clicker Question?

(A)



(B)

The (stupid) computer does the drawing steps **in the order it is programmed to!**



(B)

```
tu.forward(100);
tu.turn(30);
tu.forward(20);
tu.forward(-100);
tu.turn(-30);
tu.forward(-20);
```

NOT what you or other thinking, loving, intelligent person **WANTS**

or

INTENDS the computer to do!

(A)

Smart idea: Reverse the steps!

- After Turtle tu is commanded to go forward by
  `tu.forward(100);`

  We can make reverse its motion with
  `tu.forward(-100);`

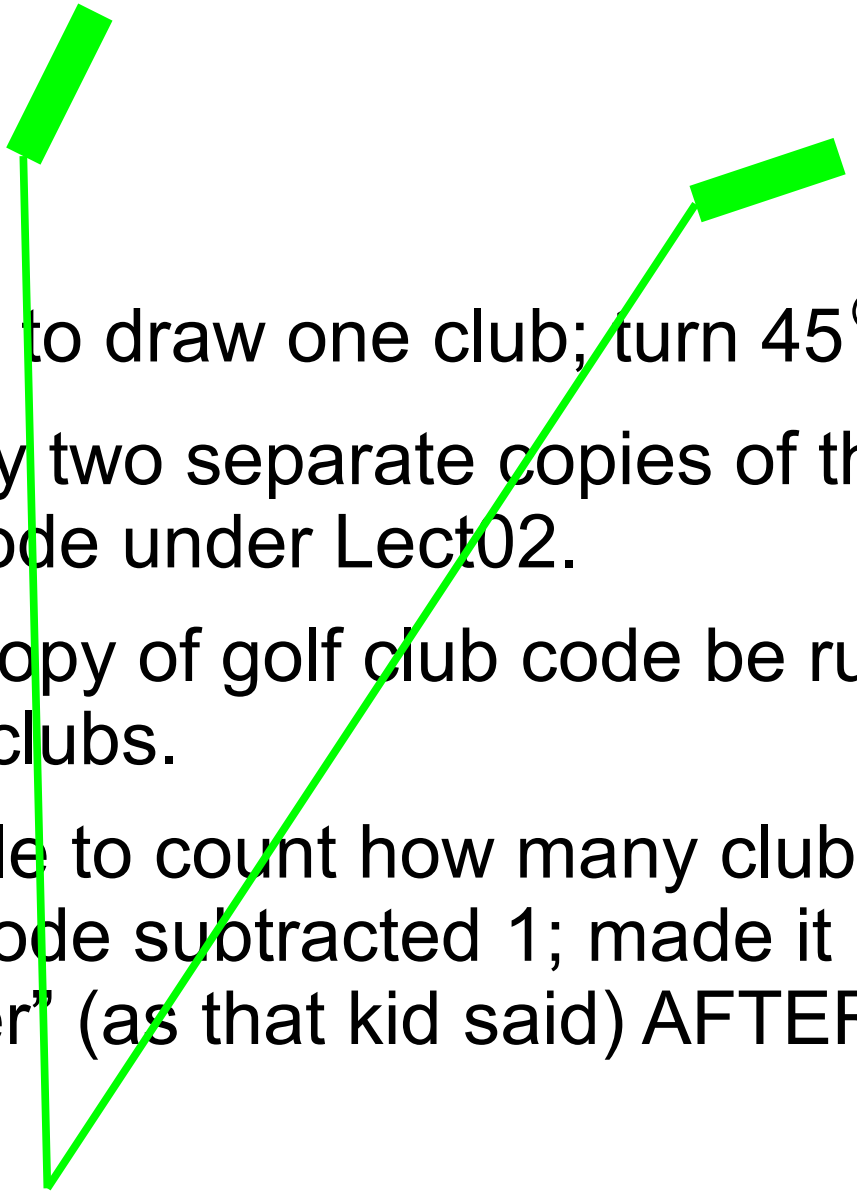
- Similarly, **`tu.turn(30);`** is reversed with
  `tu.turn(-30);`

- BUT: Reverse a series of moves by writing the reverse of each ***IN REVERSE ORDER***!

```
tu.forward(100);
tu.turn(30);
tu.turn(-30);
tu.forward(-100);
```

Lecture 03

- DONE:
  - Created 9 lines of code to draw one club; turn 45°
  - Two golf clubs drawn by two separate copies of the same code. See that code under Lect02.
  - A loop that made one copy of golf club code be run 7 times, to draw 7 golf clubs.
  - The loop used a variable to count how many clubs remain to be drawn. Code subtracted 1; made it get “smaller and smaller” (as that kid said) AFTER EACH club was drawn.



Lecture 03

- DONE:
  - Two copies of the same code.
  - A loop that made one copy of code run 7 times.
  - A variable to count how many clubs remain to be drawn. Code subtracted 1; made it get “smaller and smaller” (as that kid said).
- Today:
  - Explain (a) a variable and (b) a loop more clearly with a while loop (instead of the for loop)
  - Use the VALUE OF A VARIABLE to specify the weight of the head.

Lecture 03

- Today:
  - Explain (a) a variable and (b) a loop more clearly with a while loop (instead of the for loop)
  - Use the VALUE OF A VARIABLE to specify the weight of the head.
- Lab 02 and next week's lecture:
  - Make a method (“subprocedure”) to draw one club.
  - Make it parametrized by weight.

VARIABLE

- NOT the same as in math. Not like x in a

  x^2 + 2x +1 = 0 solve for x problem!

- **`int numClubsLeft;` means *"Get a dry-erase board named numClubsLeft"***
- **`numClubsLeft = 7;` means *"Write a 7 on the board so everyone can see it"***
- **`( numClubsLeft > 0 )` means "Look at the number written on the board and answer whether or not it is > 0"**

Our program

- Look at this lecture's program on the web and study it!
- The number written and visible on the dry-erase board named numClubsLeft is used for everyone to know “how many more golf clubs are left for the Turtle to draw”
- We want 7 clubs; so we start with the count of 7 and subtract one after drawing each club.
- We should draw another club while (as long as) that count remains > 0.
- We then made the head width be set from that number, so the head widths varied.

```
numClubsLeft = numClubsLeft - 1;
```

- This is false (or nonsense) in math!
- It means: ***"Look at the number written on the dry-erase board. Tell somebody to subtract 1 from it and tell you the result. Then, overwrite the number on the dry-erase board with that result."***
- That's what's abbreviated by = in Java! (A mouthful.)