Arduino Programming Part 7: Flow charts and Top-down design

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Goals

Introduce flow charts

- ❖ A tool for developing algorithms
- ❖ A tool for documenting algorithms
- ❖ A visual method of communicating about any sequential or iterative process
- ❖ Great for visual learners!

Top-down design

- ❖ One technique for creating a plan for large, multi-step problems
- ❖ Not tied to flow charts, but can be used effectively with flow charts

Flow chart symbols

Symbol	Name	Description
(rounded rectangle)	Terminator	Start or stop a sequence. May contain module name.
(rectangle)	Process	A step in the process or computational algorithm
(parallelogram)	Data input	Information from outside of the algorithm or process
(diamond)	Decision	Choose a flow path for continuing the algorithm or process
(arrows)	Flow indicators	Connect other elements
(circle)	Connector or Junction	Optional joint where flow indicators merge
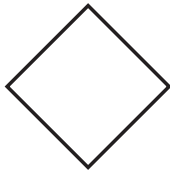
Exercise 1

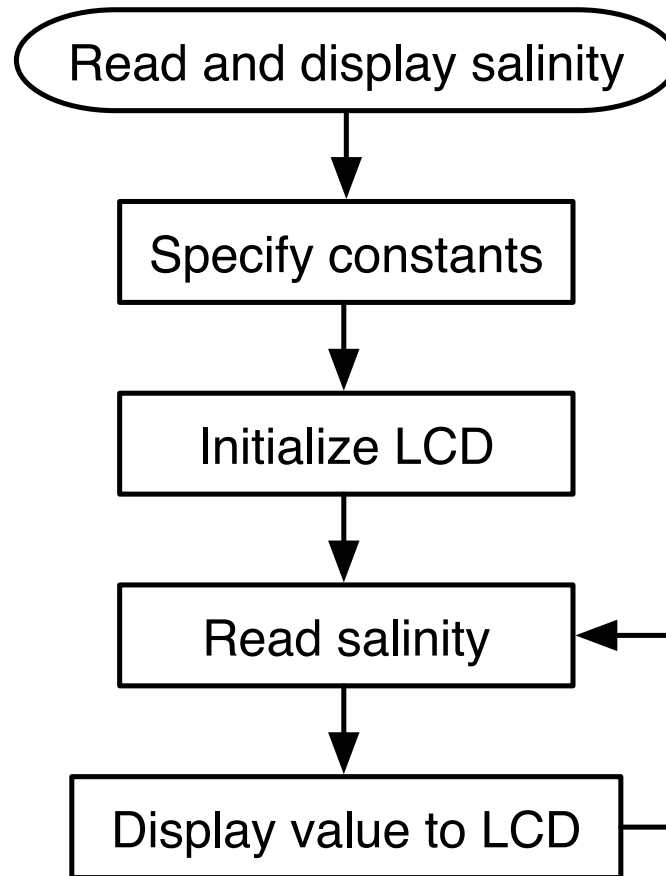Draw the flow chart to read and display the salinity value on the LCD monitor

Keep it simple

- ❖ 5 or so symbols (not counting arrows)
- ❖ Describe only the high level actions
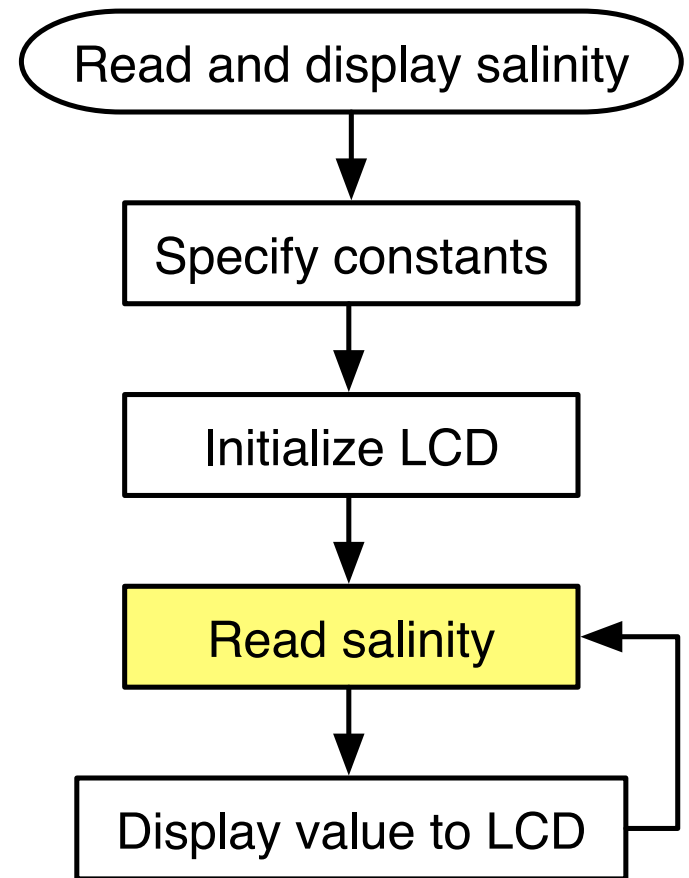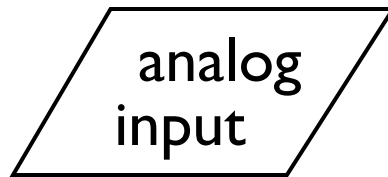
Exercise 1

Your answer goes here.

Exercise 1

```
  ┌─────────────────────────────┐
  (   Read and display salinity  )
  └─────────────────────────────┘
                │
                ▼
      ┌───────────────────┐
      │  Specify constants │
      └───────────────────┘
                │
                ▼
      ┌───────────────────┐
      │   Initialize LCD   │
      └───────────────────┘
                │
                ▼
      ┌───────────────────┐
      │   Read salinity    │◄───┐
      └───────────────────┘    │
                │              │
                ▼              │
      ┌───────────────────┐    │
      │ Display value to LCD├───┘
      └───────────────────┘
```

Exercise 2

Expand the "Read salinity" step in another flow chart

- ❖ Keep it simple
- ❖ "analog data" is an external input

analog input

Read and display salinity

Specify constants

Initialize LCD

Read salinity

Display value to LCD

Exercise 2

Your answer goes here.

Exercise 2


```
Read salinity
   │
   ▼
output pin, ──────▶ ○
input pin           │
                    ▼
            Turn on power
                    │
                    ▼
                  Wait
                    │
                    ▼
analog ──────▶ Read analog input
value               │
                    ▼
            Turn off power
                    │
                    ▼
                  Stop
```
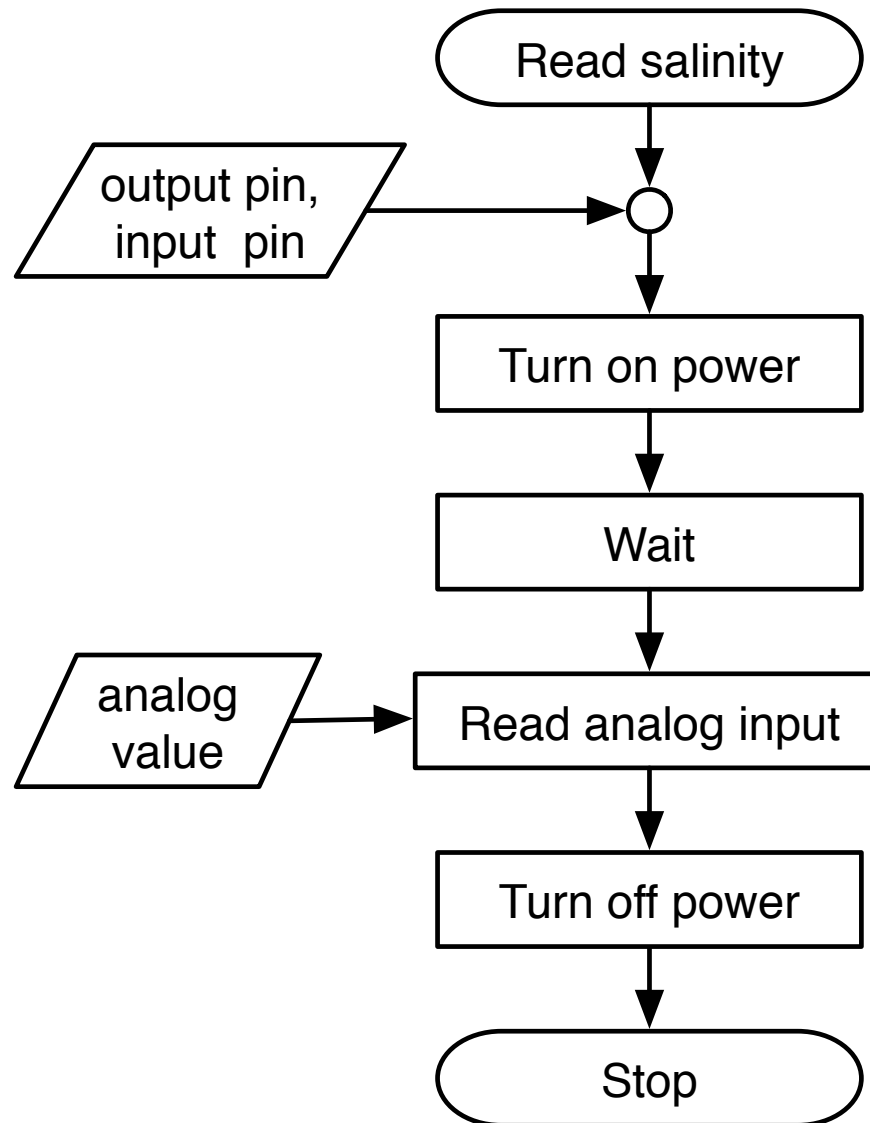
Exercise 3

Expand the "Read analog input" step in another flow chart
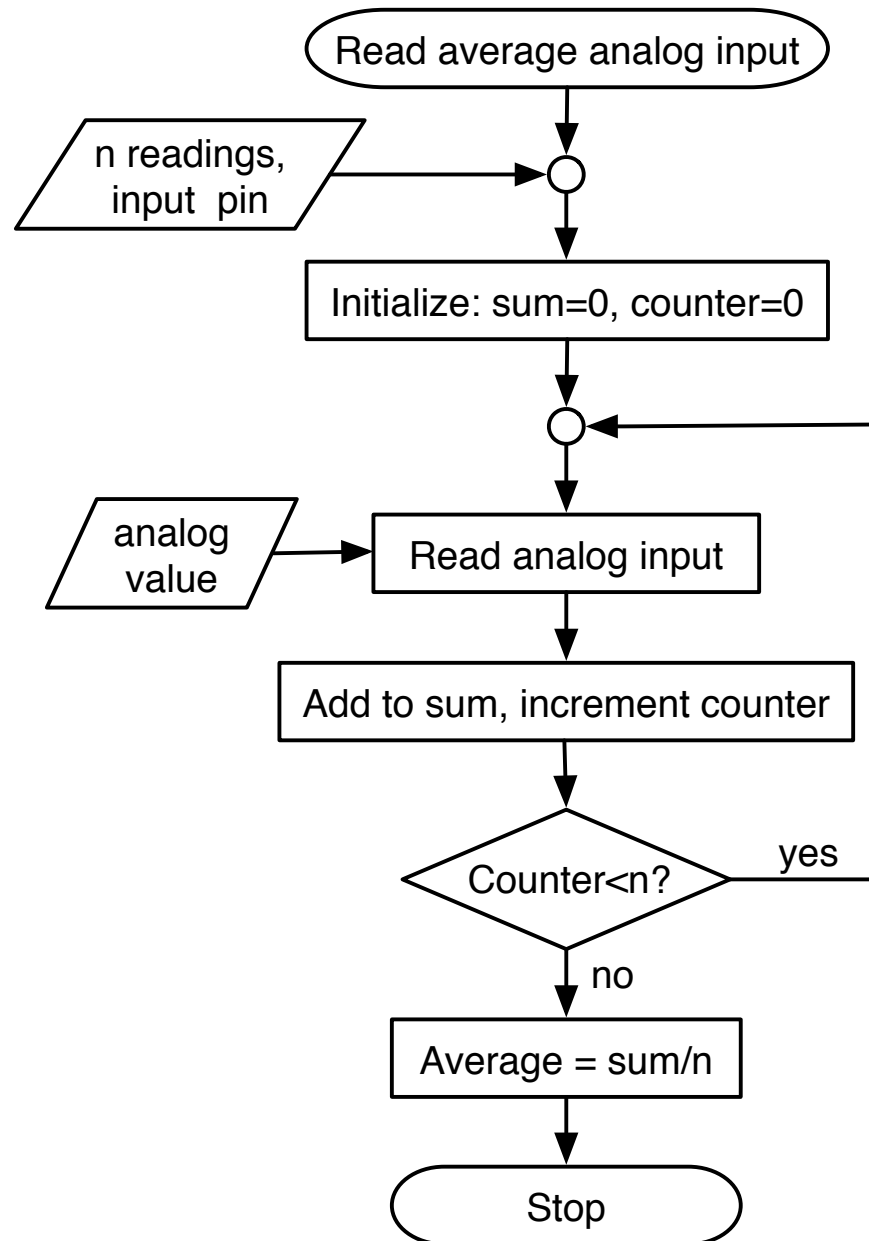
- ❖ Compute the average of n readings
- ❖ "analog data" is an external input
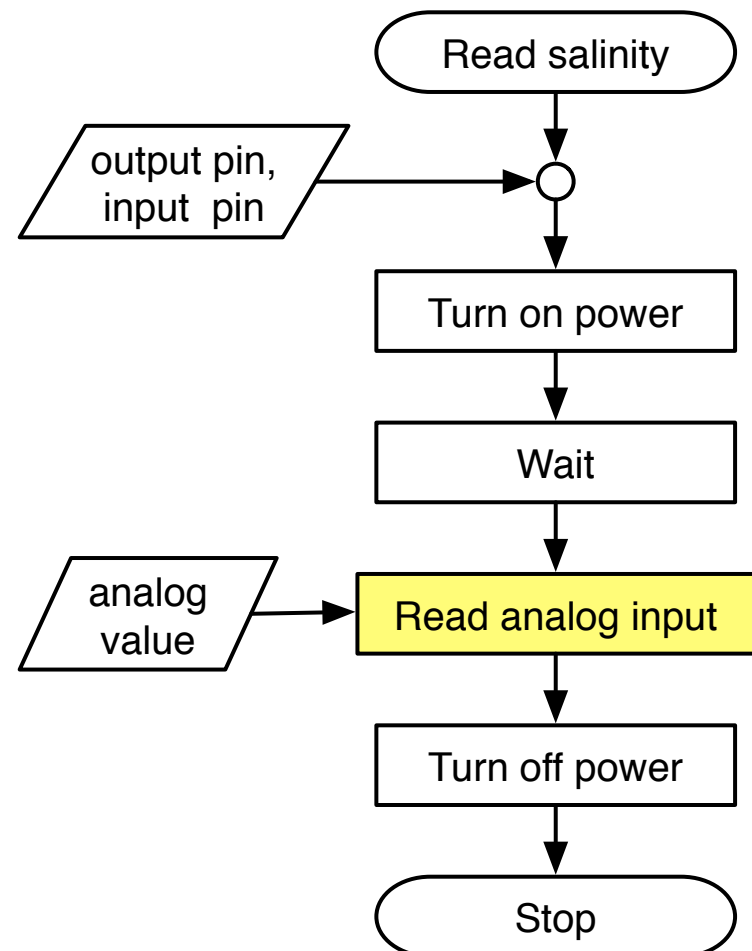
Exercise 3

Your answer goes here.

Exercise 3

Top-down design

1. Start with a general statement of the solution
   a. List the main steps
   b. Don't worry yet about details
2. Pick one of the steps
   a. Break this step into a manageable number of sub-steps
   b. Don't worry about too many of the details
   c. Apply step 2 to one of steps just generated

Top-down design

Recursive refinement: from general to specific
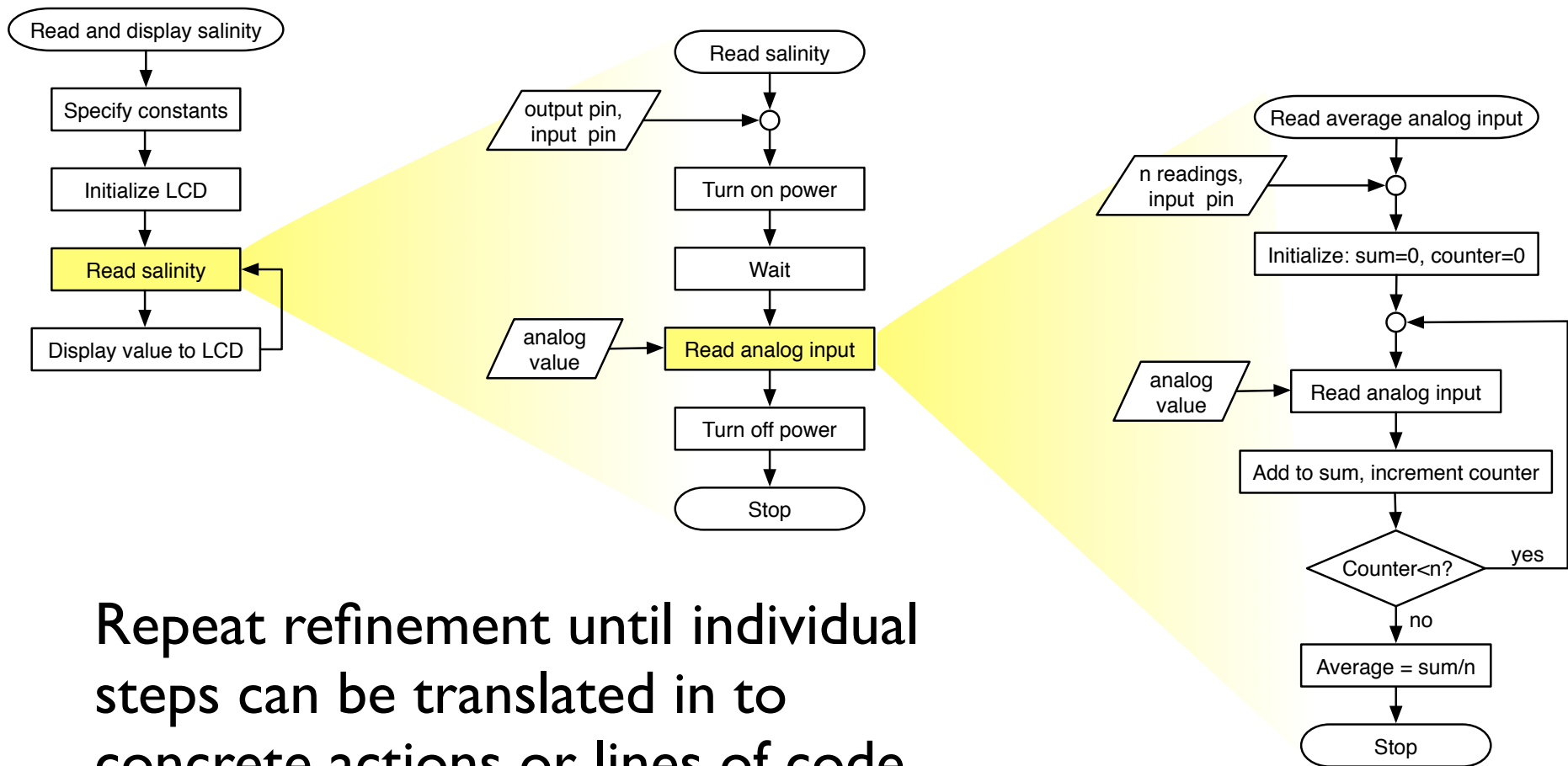
Repeat refinement until individual steps can be translated in to concrete actions or lines of code