Objectives
• Defining classes
• Using our classes
• Broader Issue: Environmental Monitoring

Creating a Counter Class
• Has a fixed range
• Starts at some low value, increments by 1, loops back around to low value if gets beyond some maximum value
• Example application of the counter: Caesar cipher for letters ‘a’ to ‘z’

Creating a Counter Class
• Data: Instance variables that represent
  ➢ High, Low, Current Value
• Methods (API)
  ➢ Counter(low, high)
  ➢ increment([amount]) Defaults to 1
  ➢ setValue(value)
  ➢ getValue()
  ➢ getLow()
  ➢ getHigh()

Applying the Counter Class
• To the Caesar Cipher program
• Plug in the Counter object and call its methods as appropriate…

Applying the Counter Class
• To the Caesar Cipher program
• Compare implementations, with and without using the counter
• Any drawbacks from using Counter class?

Extra Credit Functionality Ideas
• Return the card’s color (Red/Black), using a constant defined at the top for each color
  ➢ What game is this useful for?
• Boolean methods: isBlack(), isRed()
• Boolean method: isOppositeColor(card)
• Boolean method: isSameSuit(card)
• Create a Hand class (very similar to Deck class)
  ➢ Methods that check if all same suit, all same rank
• Player class for various games …
• Test/Demonstrate your methods

Due Tuesday before lab
Quote of the NCAA Tourney

This is the guy who has to get it done for Binghamton. He’s their CPU if this is a computer…. He’s the operating system…. He’s the processing unit, the one that makes everything happen.

-- Clark Kellogg on Emanuel Mayben

BROADER ISSUE

Broader Issues: Environmental Monitoring

- Interdisciplinary projects involving sensor networks
  - Important new-ish CS research area
- Disclaimer:
  - Not a seismologist or a biologist
- Groups
  Overview: Chen, Sara, Ben
  Volcano: Aaron, Kevin, Michelle, Mike, Greg, Dylan
  Zebra: Charles, Carrie, Russ, Craig, Taylor
  Zebra: Thomas, Camille, David, Mallory

Discussion

- What are the CS challenges to the projects?
  - Any challenges only applicable to one project?
- How does the environment impact the CS research problems/solutions?
- How did the researchers address these challenges?
  - How would you address the challenges?

Overview of Challenges: Efficiency

- Some programmers thought that efficiency didn’t matter anymore
  - GB of memory, terabytes of storage on machines
- Now: small and embedded devices
  - Need to be efficient!
- Energy in battery powered nodes
- Amount of data stored (when to delete?)
- When, amount of data transferred

Overview of Challenges: Reliability

- Data delivery
  - Missing data
  - Connectivity (good signal?)
  - Duplicate data (different sources?)
  - Dead sensor nodes
  - Calibration of data (time synchronization)
- Nodes
  - Withstand extreme weather, conditions
  - Battery life
- Robustness: recover from software failure/malfunction or bad data
Overview of Challenges

- Testing
  - Accurately simulate conditions (which will vary widely over long periods of time)
- Different goals from domain scientists
  - CS: push boundaries of sensor networks
    - Example: Improve reliability of data to 95%
  - Seismologists: need 100% reliable data

Overview of Solutions: Efficiency

- Energy in battery powered nodes
  - Solar-powered batteries
  - Only transmit if new data
- Amount of data stored (when to delete?)
  - Notify all when data gets to base station
- When, amount of data transferred
  - ZebraNet: only transmit if new data
    - Only transmit if zebra gives data to base
  - Volcano: only when "interesting" data

Overview of Solutions: Reliability

- Data delivery
  - Redundancy of data -- verify/validate it is correct
  - Only send to zebras with history of reporting back to base station
- Nodes
  - Weather proofing
  - Batteries: solar-panels to recharge

Overview of Solutions: Testing

- Novel simulations!
- Emulate environment/scenarios on computer
- Emulate zebras with horses
- Push software to make sure it “recovers” appropriately from errors or bad information