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Designing Algorithms

CS 124 – Intro to Software Development

Macbeth – Lesson 5.3

Agenda

- Opening Prayer
- Music Friday
- Q&A
- Designing Algorithms
  - Review Assignment
  - calculateOffset
- Looking Ahead

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Music Friday

Let Us All Press On (Hymn 243)

Let us all press on in the work of the Lord,
That when life is o'er we may gain a reward;
In the fight for right let us wield a sword,
The mighty sword of truth.

Fear not, though the enemy deride;
Courage, for the Lord is on our side.
We will heed not what the wicked may say,
But the Lord alone we will obey.

Designing Algorithms

- Think about the big picture.
- Write down your algorithm in a way that both you and others can understand:
  - Written Text
  - Block Diagrams or Flow Charts
  - Pseudo Code

Example: Design an algorithm to dispense coins using the fewest number of coins.

Written Text

The change algorithm will determine the best distribution of quarters (25¢), dimes (10¢), nickels (5¢), and pennies (1¢).

To determine the best distribution, the change algorithm will first dispense quarters until the dispensing of one more quarter would exceed the amount of change to provide.

The change algorithm will repeat this process with the dimes, and then the nickels.

Finally, the change algorithm will dispense pennies until the desired amount of change has been reached.

Pseudo Code

```
makeChange(change, quarters, nickels, dimes, pennies)
        SET changeInt = change * 100                    // Need it to be an integer
        SET quarters = changeInt div 25                 // Find max number of quarters
        SET changeInt = changeInt – (quarters * 25)     // Dispense quarters
        SET dimes = changeInt div 10                    // Find max number of dimes
        SET changeInt = changeInt – (dimes * 10)        // Dispense dimes
        SET nickels = changeInt div 5                   // Find max number of nickels
        SET changeInt = changeInt – (nickels * 5)       // Dispense nickels
        SET pennies = changeInt                         // Dispense pennies
END
```

Another Example

Design an algorithm that calculates shipping costs for a website:

- $10 for up to 2 pounds
- Plus 50 cents for each pound over 2 pounds
- Up to a maximum of $30

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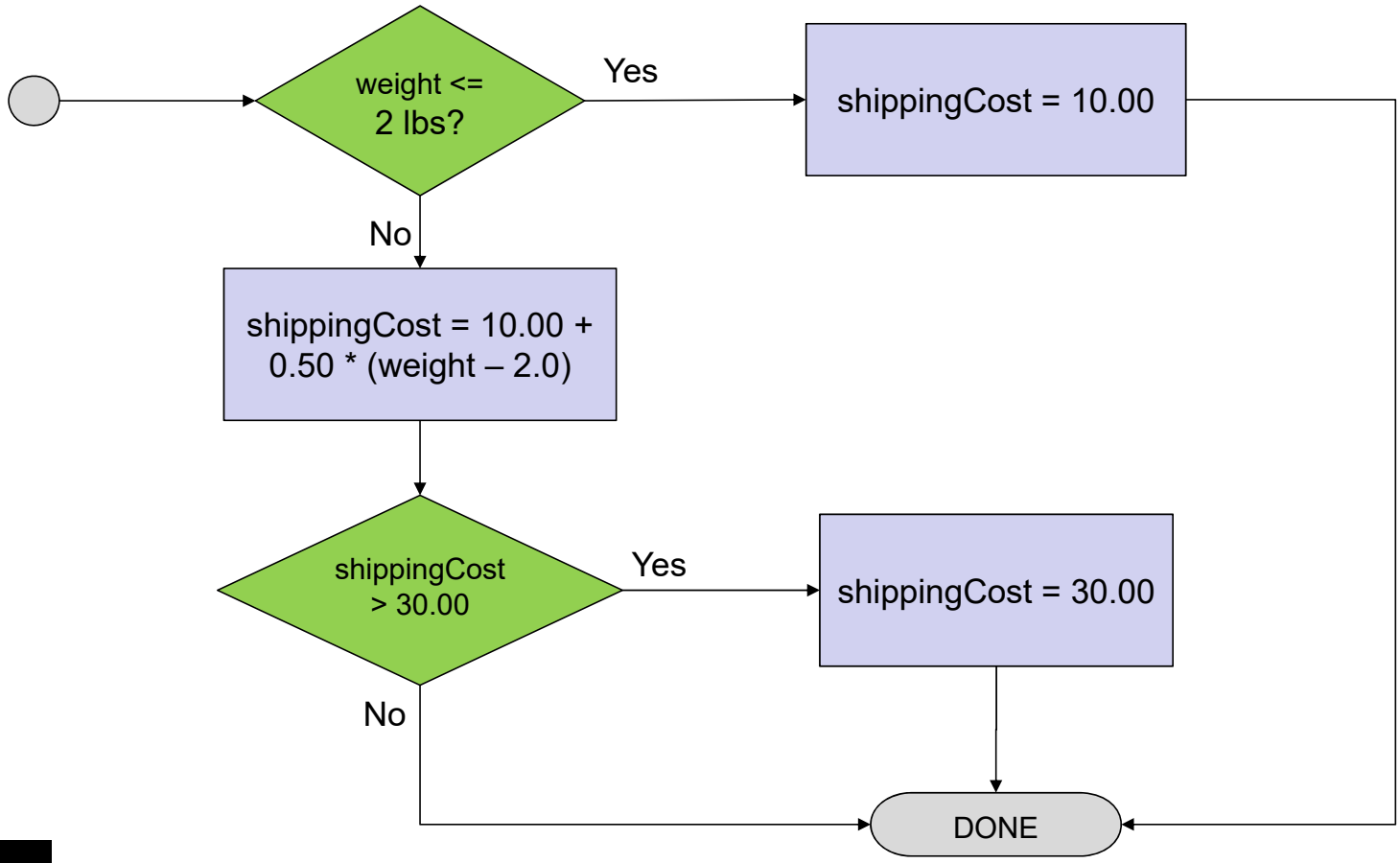
Flow Chart



Pseudo Code

```
calculateShipping(weight)
        IF weight <= 2.0
                SET shipping = 10.00
        ELSE
                SET shipping = 10.00 + 0.50 * (weight – 2.0)
                IF shipping > 30.00
                        SET shipping = 30.00
        RETURN shipping
END
```

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Review Assignment 22

calculateOffset

Problem: To determine the offset (day of the week for the 1st day of the month), we need to know how many days have past since January 1, 1753.

How do you count?

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calculateOffset

The calculateOffset algorithm will count the number of days in previous years. For each year:

a) If it was a leap year, then the year had 366 days

b) If it was not a leap year, then the year had 365 days

The calculateOffset algorithm will count the number of days in the previous months for this year: For each month:

a) If the month was Sept, Apr, Jun, or Nov, then the month had 30 days

b) If the month was Feb and it was a leap year, then the month had 29 days

c) If the month was Feb and it was not a leap year, then the month had 28 days

d) Otherwise, the month had 31 days

The total days can be used to determine the offset (Monday = 0, Sunday = 6). You will write the pseudo code for this in the project next week. The project description next week explains this more.

Looking Forward

- Before Class on Monday
  - Read Section 2.3 – Loop Syntax
  - Assignment 2.3
  - Turn in Project 05 – Print out hardcopy. Plus 10 points if it is not hand drawn.

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