

## COMPUTER SCIENCE

### LAB 10 - STRUCTURES

*Adapted from "Structures in Four Passes", Todd O'Bryan, duPont Manual High School, Louisville, KY*

Write the functions below using your structure definitions and templates from the worksheet. Write each function **directly** underneath the matching definition/template.

1. When books aren't selling well, they get discounted. Write a function **discount-book** that consumes a **book** and returns the same book with the price discounted 25%. Prices should be rounded to two decimal places.
2. Write the function **total-length** which consumes two **songs** and returns the total playing time in seconds.
3. Write the function **same-department?**. It consumes two **classes** and returns true if they're in the same department and false otherwise.
4. Write the function **carbon-footprint** that consumes an **auto** and returns a **string**. The output will depend on the mpg estimate of the car. If the mpg is < 15, the output is "gas guzzler". If the mpg is 15-30, the output is "middle of the road". Over 30 mpg but less than 40 is "green machine". 40 mpg and over returns "tree hugger".

For the following exercises, you will need these constant definitions:

```
(define WIDTH 600)
(define HEIGHT 500)
(define MYCAT (make-cat 0 400 3 "right" 600))
```

You will also need to define the following cat images as constants that will be used to animate your cat.

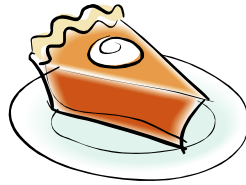


5. Define the function, **update**, which takes a cat as input, and outputs the cat, updated as follows:
  - the x position of the cat is updated by the speed of the cat. If the cat's direction is "right", the x position is increased by the speed. If the cat's direction is "left", the x position is decreased by the speed.
  - the y position remains the same.
  - the speed remains the same.
  - if the cat's position is within range (half the image-width), of touching either side of the window, change its direction: ("right"->"left", "left"->"right"). Otherwise, it remains the same.
  - Decrease the cat's hunger level by 1.
6. Define the **render** function. This function takes a cat as input and outputs a scene. The function will draw the cat in an empty scene at its current position. It will use the correct image (above), depending on the cat's direction. The function will also depict the cat's hunger level as a bar along the bottom of the window. The length of the bar will equate to the hunger level. The bar should shrink to the left (not shrink towards the middle of the screen).
7. Create a function **dead-cat?** that takes a cat as input and returns true if the cat's hunger level is at or below zero.
8. Now test your set of function with an animation, using the following big-bang function call:

```
(big-bang MYCAT (on-tick update)
               (on-draw render) (stop-when dead-cat?))
```

9. Add a **key-event-handler** to the cat animation. If the user presses the left or right arrow keys, change the direction of the cat according to the key press. If the user presses the space bar, the cat gets fed. Increase the cat's hunger level by 10 each time the space bar is pressed.

## Dessert



**Note: Copy necessary functions and definitions from main part of lab into a separate file for the dessert portion of the lab. This will keep the added cat functionality separate.**

7. Add a flip to the cat's bounce off the wall. Instead of just changing direction, have the cat do a flip once it hits a wall, then reverse direction and continue on until it hits the opposite wall.
8. Add the following functionality to the cat animation. Add up and down directions. You will need to add two more images to represent the cat moving up and down in the universe. The cat will reverse direction when it touches the top and bottom walls (keep the cat above the hunger meter at the bottom of the screen) as it does for the left and right walls. The up and down arrows will also allow the cat to move in those directions. Add flipping to the up/down directions.
9. [Graphical Editor](#) exercises from textbook HTDP2e. (exercises 65-68)