

Homework 6

Due: 2:30 PM Apr. 17, 2008

For this assignment, you should save all your code in the directory

```
/u/<login>/course/cs004/hw6
```

To run the handin script, enter the following command in a terminal:

```
cs004_handin hw6
```

No stencil code is provided for this homework. You should refer to the lectures and your lab assignments to get you started if you do not remember exactly how to structure a program in C.

Problem 6.1

In this task you will write a program that calculates the user's Body Mass Index (BMI) based on height (h , in inches) and weight (w , in pounds). The program should then let the user know if, according to their BMI, they are underweight, in the normal range, overweight, or obese. BMI is calculated using the following formula:

$$BMI = \frac{w}{h^2} 703$$

A person is considered:

- Underweight when BMI is less than 18.5
- Normal weight when BMI is 18.5 - 24.9
- Overweight when BMI is 25 - 29.9
- Obese when BMI is 30 or greater

A sample run of the program might look like this:

```
Enter your height (in inches): 75
Enter your weight (in pounds): 180
Your BMI is 22.496000
You are in the normal weight range.
```

Implement your program in a file called `bmi.c`. Compile it by running the command `gcc -Wall -o bmi bmi.c`, and run it with `./bmi`.

Problem 6.2

Back in high school, when you were working with quadratic formulas, you probably wished you had an easy root finder. Maybe you even wrote one into your TI83. In this problem, you'll write a quadratic root finder that will find a solution to problems of the form $ax^2+bx+c = 0$. You'll have to take care of real and imaginary roots. Write your program in a file named `quadratic.c`.

For this problem, you'll be solving these quadratic equations using the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

A sample of what this program should look like

```
# ./quadratic
Enter coefficient a
> 1
Enter coefficient b
> 4
Enter coefficient c
> 3
Solutions:
-1.000000
-3.000000
```

You should also watch out for imaginary roots. For example, in the equation $x^2 + 4x + 5$, the solutions would be $-2 + i$ and $-2 - i$, where the letter i shows that the number is imaginary. The sign of the expression $b^2 - 4ac$ will tell you whether or not the root is imaginary. If it's positive, the roots will

be real; if it's negative, the roots will be imaginary and you'll have to take the absolute value of that expression before taking the square root. If the roots are imaginary, the output should look like:

```
# ./quadratic
Enter coefficient a
> 1
Enter coefficient b
> 4
Enter coefficient c
> 5
Solutions:
-2.000000+i
-2.000000-i
```

Since you will be using the `sqrt()` function for this problem, don't forget to include `<math.h>` at the beginning of your program. Compile your program with the command

```
gcc -Wall -o quadratic quadratic.c -lm
```

Here the `"-lm"` flag tells it to include C's math-related functionality.

Problem 6.3

For this last problem, you'll be writing an application to help an extremely absentminded zoo keeper remember the diets of his animals. The following is a table listing what each type of animal at the zoo eats:

Tigers	Meat
Monkeys	Bananas
Zebras	Grass
Lions	Meat
Anteaters	Ants
Pandas	Bamboo
Orangutan	Bananas

The output of your program should look something like this:

```
> ./zoo
1) Tiger
2) Monkey
3) Zebra
4) Lion
5) Anteater
6) Panda
7) Orangutan
What type of animal are you feeding?
2
Feed it bananas.
```

In order to receive full credit on this problem, you must use a `switch` statement and no `if` statements.

Implement your program in a file called `zoo.c`. Compile it by running the command `gcc -Wall -o zoo zoo.c`, and run it with `./zoo`.