COMP1511 - Programming Fundamentals

Term 1, 2020 - Livestream

Let's write some code

Element Benders are having a fight in a forest!

- A team of four benders against one very powerful enemy
- We'll create a struct that represents a bender
- We'll have four of them in a team
- And one who will fight them all
- We'll create some functions that pit the benders against each other
- We'll loop a series of attacks until either side has lost

Create Structs for Characters

Create a struct to allow us to represent the characters

We'll borrow the one we created earlier

```
struct bender {
    char name[MAX_LENGTH];
    char element[MAX_LENGTH];
    int power;
    int health;
};
```

Create the actual struct variables

The struct is defined, now we create the actual variables

- The team can be in an array

```
int main (void) {
    struct bender companions[TEAM_SIZE];
    strcpy(companions[0].name, "Avatar Aang");
    strcpy(companions[0].element, "Air");
    companions[0].power = 10;
    companions[0].health = 5;
    strcpy(companions[1].name, "Katara");
    strcpy(companions[1].element, "Water");
    companions[1].power = 7;
    companions[1].health = 7;
    // etc
```

The struct is a variable type

Each instance of the struct can have a different name and stats

- Which means we can use the same struct for different characters!
- It also means that any of our characters are now interchangeable

```
struct bender zuko;
strcpy(zuko.name, "Prince Zuko");
strcpy(zuko.element, "Fire");
zuko.power = 20;
zuko.health = 20;
```

Let's use a function for a single attack

We pass pointers to structs in the function

This allows the function to make changes to our characters

```
void attack(struct bender *attacker, struct bender *target) {
    printf("%s attacks %s for %d damage.\n",
        attacker->name, target->name, attacker->power
    );
    target->health -= attacker->power;
    if (target->health <= 0) {
        // target has run out of health
        printf("%s is knocked out.\n", target->name);
    }
}
```

Passing addresses into functions

- We're passing addresses of structs to the attack function
- We do this by declaring that the function takes pointers as input (*****)
- And when we call the function, we provide the addresses (**&**) of the variables
- This allows the function to know where it can access our data (including the ability to change it)

Calling the attack function

If we just want a duel between one bender and Zuko

```
int teamCount = 0;
attack(&zuko, &companions[teamCount]);
attack(&companions[teamCount], &zuko);
```

But if we want to be able to use pointers to each of them

```
int teamCount = 0;
struct bender *companion = &companions[teamCount];
struct bender *prince = &zuko;
attack(prince, companion);
attack(companion, prince);
```

Let's fight until one side loses

Let's loop and keep attacking until either side is knocked out

- We'll need a function that tells us whether either side has run out of health
- Then we'll need a loop that keeps the fight going, letting the companions step in for each other if one is knocked out

stillAlive()

```
int stillAlive(struct bender *solo, struct bender team[TEAM_SIZE]) {
    int sAlive = 1;
    int tAlive = 0;
    if (solo->health <= 0) {
        sAlive = 0;
    }
    int i = 0;
    while (i < TEAM_SIZE) {
        if (team[i].health > 0) {
            tAlive = 1;
        }
        i++;
    }
    return sAlive * tAlive;
}
```

The main loop

```
int teamCount = 0;
struct bender *companion = &companions[teamCount];
declareElement(companion);
struct bender *prince = &zuko;
while (stillAlive(prince, companions)) {
    if (companion->health <= 0) {
        // this companion is knocked out, move on
        benderCount++;
        companion = &companions[teamCount];
        declareElement(companion);
    } else {
        attack(prince, companion);
        attack(companion, prince);
    }
}
```

The declareElement function

A void function doesn't give any information back to the rest of the program but it still might have some useful side effects

```
// A simple function to declare a bender's name and their element
void declareElement(struct bender *fighter) {
    printf(
        "%s wields the element: %s\n",
        fighter->name,
        fighter->element
    );
}
```

We might want a bit more variation

Introducing rand() - A random number generator from C's Standard Library

- Calling `rand()` will return an int from a generated sequence
- The sequence appears random
- But if we run the program again, it will generate the same sequence!

- `srand()` allows us to give a seed to our random number generator
- We can use "seed" values to select different sequences to use
- If we try to run different seeds every time, we'll get different sequences

Seed the rand() with command line input

- We can take input from the command line that ran the program and use that as our seed value
- This lets us change the sequence each time

```
int main (int argc, char *argv[]) {
    if (argc > 1) {
        // if we received a command line argument,
        // use that as our random seed
        srand(strtol(argv[1], NULL, 10));
    }
```

Let's add some randomness to the attack

Using rand and % we can get an int that's between 0 and a number

- Now the damage is inconsistent, we won't always know the result

```
void attack(struct bender *attacker, struct bender *target) {
    int damage = rand() % attacker->power;
    printf("%s attacks %s for %d damage.\n",
        attacker->name, target->name, damage
    );
    target->health -= damage;
    if (target->health <= 0) {
        // target has run out of health
        printf("%s is knocked out.\n", target->name);
    }
}
```

So we have a complete element bender battle!

We're looping through the fight and we don't always know the outcome!

- We've declared our first struct
- We also used it just like a variable in an array
- We passed pointers to our structs into functions

What's next?

- Can you write better style than this?
- There are a few places where separating things into functions would be very effective at increasing readability!