typedef

We can use the keyword `typedef` to give a name to a type:

```
typedef double real;
```

This means variables can be declared as **real** but they will actually be of type **double**.
Do not overuse typedef - it can make programs harder to read, e.g.:

```
typedef int darthVader;

darthVader main(void) {
    darthVader i,j;
    ....
```

Using typedef to make programs portable

Suppose have a program that does floating-point calculations.
If we use a typedef'ed name for all variable, e.g.:

```
typedef double real;

real matrix[1000][1000][1000];
real myAtanh(real x) {
   real u = (1.0 - x)/(1.0 + x);
   return -0.5 * log(u);
}
```

If we move to a platform with little RAM, we can save memory (and lose precision) just by changing the typedef:

```
typedef float real;
```

enums

- ENUMS (enumerations) is a custom data type, which describes set of possible values in a programmer-defined category
- For example, days of the week

```
#include <stdio.h>
enum weekdays {Monday, Tuesday, Wednesday,
               Thursday, Friday, Saturday, Sunday};

int main() {

    enum weekdays day;
    day = tuesday;
    if (day == Tuesday) {
        printf("Lecture day\n");
    }
    return 0;
}
```

Using typedef to make programs portable

```
#include <stdio.h>
enum weekdays {Monday, Tuesday, Wednesday,
               Thursday, Friday, Saturday, Sunday};
typedef enum weekdays week;
int main() {

    week day; // make a new variable called day,
    .....
}
```

structs

- We have seen simple types e.g. **int, char, double**
  - variables of these types hold single values
- A compound type: structs
  - structs hold multiple values (fields)
  - struct are heterogeneous - fields can be differenttype
  - struct field selected using name
  - struct fields are fixed

structs - example

If we define a struct that holds CP1511 student details:

```c
#define MAX_NAME 64
#define N_LABS 12
struct student {
    int zid;
    double totallabMarks;
    double assignment1Mark;
    double assignment2Mark;
}
```

We can declare an array to hold the details of all students: (We will learn about it later)

```c
struct student cp1511Students[400];
```

Combining structs and typedef

Common to use typedef to give name to a struct type.

```c
struct student {
    int zid;
    double totallabMarks;
    double assignment1Mark;
    double assignment2Mark;
}
typedef struct student Student;
Student cp1511Students[400];
```

We use the convention that for the typedef we use should be the same as the tag, but starting with a capital letter.

Assigning values to structs

```c
int main(void){
   Student s;
   s.zid = 12345678;
   s.totallabMarks = 14;
   s.assignment1Mark = 10;
   //etc
}
```

Assigning structs to structs

Unlike arrays, it is possible to copy all components of a structure in a single assignment:

```
Student student1, student2;
...
student2 = student1;
```

Comparing structs

It is *not* possible to compare all components with a single comparison:

```
if (student1 == student2) // NOT allowed!
```

If you want to compare two structures, you need to write a function to compare them component-by-component and decide whether they are “the same”.

Nested Structures

One structure can be nested inside another

```
typedef struct date      Date;
typedef struct time      Time;
typedef struct parkingTicket ParkingTicket;
struct date {
   int day, month, year;
};
struct time {
   int hour, minute;
};
struct parkingTicket {
   Date   date;
   Time   time;
   char   plate[MAX_PLATE];
};
```