

typedef

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

```
typedef double real;
```

This means variables can be declared as **numeric** but they will actually be of type **double**.

Do not overuse typedef - it can make programs harder to read, e.g.:

```
typedef int andrew;
```

```
andrew main(void) {  
    andrew 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 my_atanh(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) by changing the typedef:

```
typedef float real;
```

structs

- We have seen simple types e.g. **int**, **char**, **double**
 - ▶ variables of these types hold single values
- We have seen a compound type: arrays
 - ▶ array variables hold multiple values
 - ▶ arrays are homogenous - every array element is the same type
 - ▶ array element selected using integer index
 - ▶ array size can be determined at runtime
- Another compound type: structs
 - ▶ structs hold multiple values (fields)
 - ▶ struct are heterogeneous - fields can be different type
 - ▶ struct field selected using name
 - ▶ struct fields fixed

structs - example

If we define a struct that holds COMP1511 student details:

```
#define MAX_NAME 64  
#define N_LABS 10  
  
struct student {  
    int zid;  
    char name[64];  
    double lab_marks[N_LABS]  
    double assignment1_mark;  
    double assignment2_mark;  
}
```

We can declare an array to hold the details of all students:

```
struct student comp1511_students[900];
```

combining structs and typedef

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

```
struct student {  
    int zid;  
    char name[64];  
    double lab_marks[N_LABS]  
    double assignment1_mark;  
    double assignment2_mark;  
}
```

```
typedef struct student student_t;
```

```
student_details_t comp1511_students[900];
```

Programmer often use convention to separate type names
e.g. `_t` suffix.

Assigning structs

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

```
struct student_details student1, student2;  
...  
student2 = student1;
```

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”.

structs and functions

A structure can be passed as a parameter to a function:

```
void print_student(student_t student) {  
    printf("%s z%d\n", d.name, d.zid);  
}
```

Unlike arrays, a copy will be made of the entire structure, and only this copy will be passed to the function.

Unlike arrays, a function can return a struct:

```
student_t read_student_from_file(char filename[]) {  
    ....  
}
```

Pointers to structs

If a function needs to modify a struct's field or if we want to avoid the inefficiency of copying the entire struct, we can instead pass a *pointer* to the struct as a parameter:

```
int scan_zid(student *s) {  
    return scanf("%d", &((*s).zid));  
}
```

The “arrow” operator is more readable :

```
int scan_zid(student *s) {  
    return scanf("%d", &(s->zid));  
}
```

If **s** is a pointer to a struct **s->field** is equivalent to **(*s).field**

Nested Structures

One structure can be nested inside another

```
typedef struct date      Date;
typedef struct time      Time;
typedef struct speeding Speeding;
```

```
struct date {
    int day, month, year;
};

struct time {
    int hour, minute;
};

struct speeding {
    Date   date;
    Time   time;
    double speed;
    char   plate[MAX_PLATE];
};
```