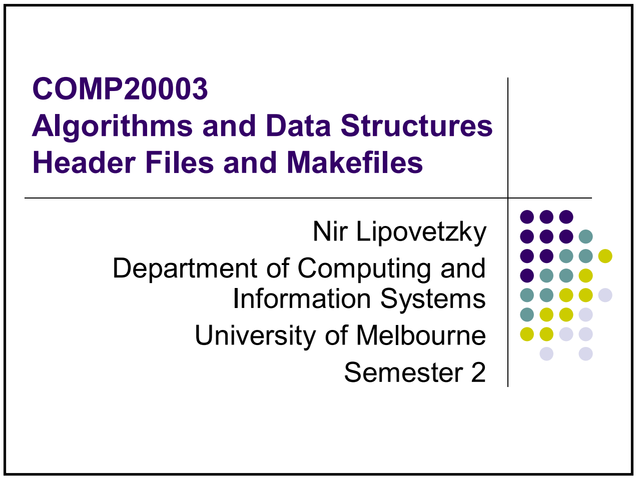

COMP20003 Algorithms and Data Structures Header Files and Makefiles

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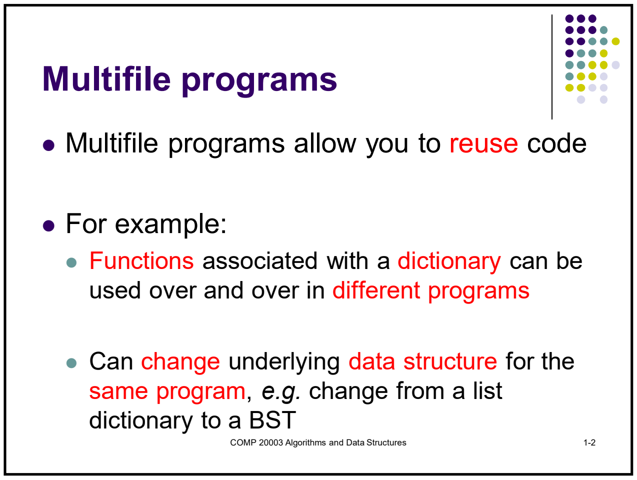
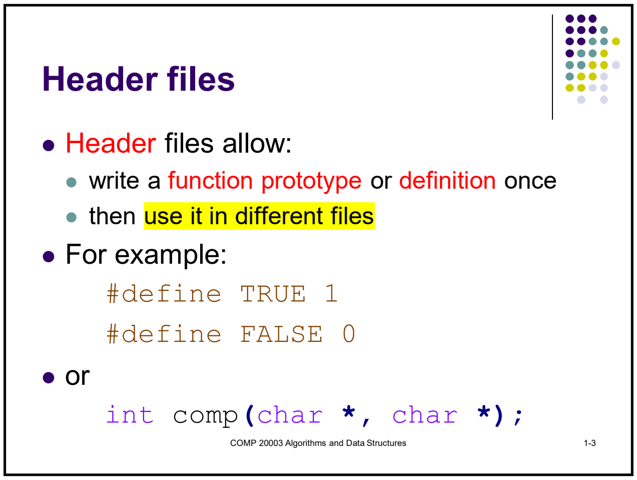
Semester 2



Multifile programs

- Multifile programs allow you to reuse code
- For example:
  - Functions associated with a dictionary can be used over and over in different programs
  - Can change underlying data structure for the same program, *e.g.* change from a list dictionary to a BST



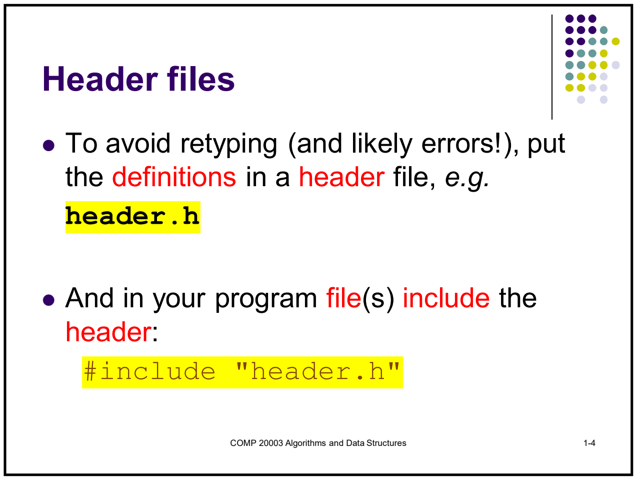
Header files

- Header files allow:
  - write a function prototype or definition once
  - then use it in different files
- For example:

```
#define TRUE 1
#define FALSE 0
```

- or

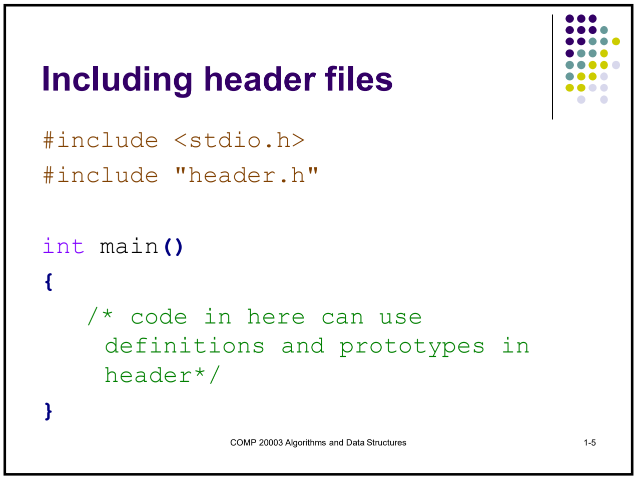
```
int comp(char *, char *);
```



Header files

- To avoid retyping (and likely errors!), put the definitions in a header file, *e.g.* **`header.h`**
- And in your program file(s) include the header:

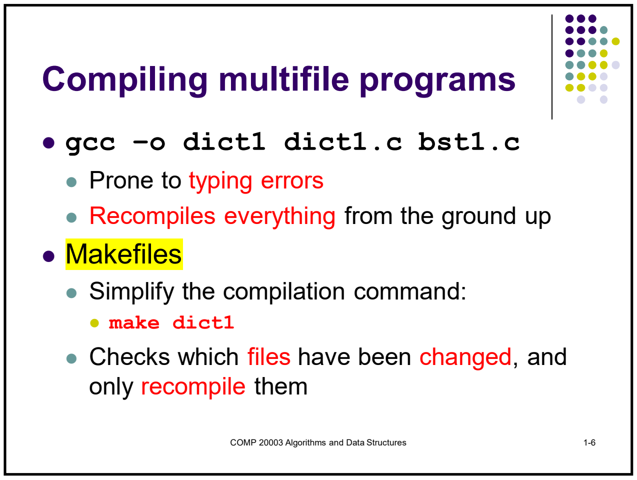
```
#include "header.h"
```



Including header files

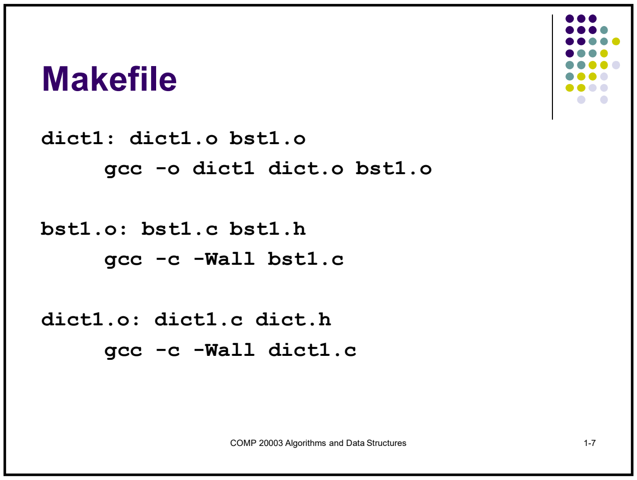
```
#include <stdio.h>
#include "header.h"

int main()
{
   /* code in here can use
    definitions and prototypes in
    header*/
}
```



Compiling multifile programs

- `gcc –o dict1 dict1.c bst1.c`
  - Prone to typing errors
  - Recompiles everything from the ground up
- Makefiles
  - Simplify the compilation command:
    - `make dict1`
  - Checks which files have been changed, and only recompile them

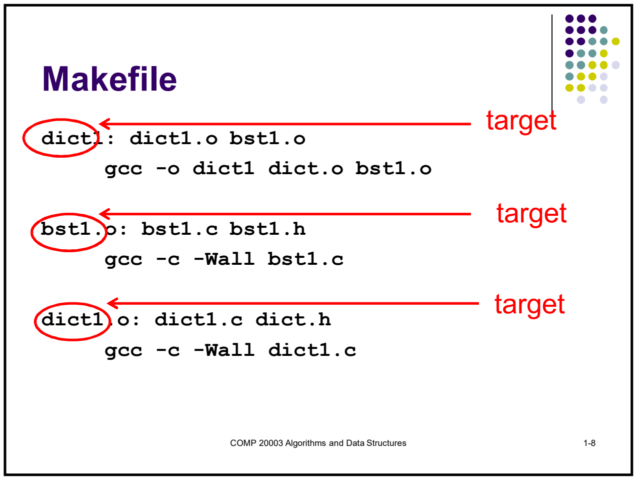


Makefile

```
dict1: dict1.o bst1.o
     gcc -o dict1 dict.o bst1.o

bst1.o: bst1.c bst1.h
     gcc -c -Wall bst1.c

dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c
```



Makefile

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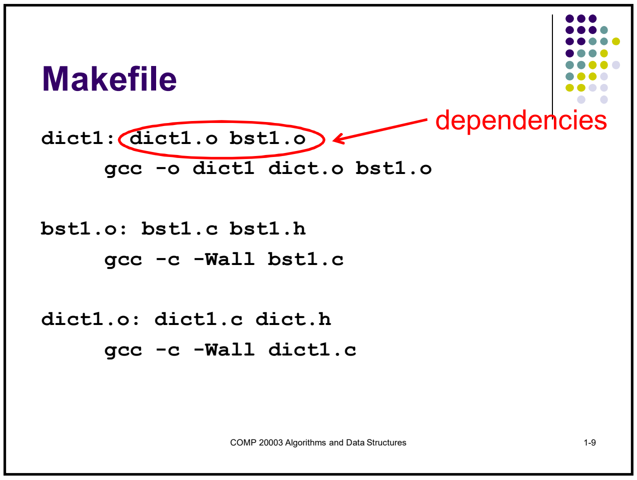
dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c
```

target
target
target



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bst1.o: bst1.c bst1.h
     gcc -c -Wall bst1.c

dict1.o: dict1.c dict.h
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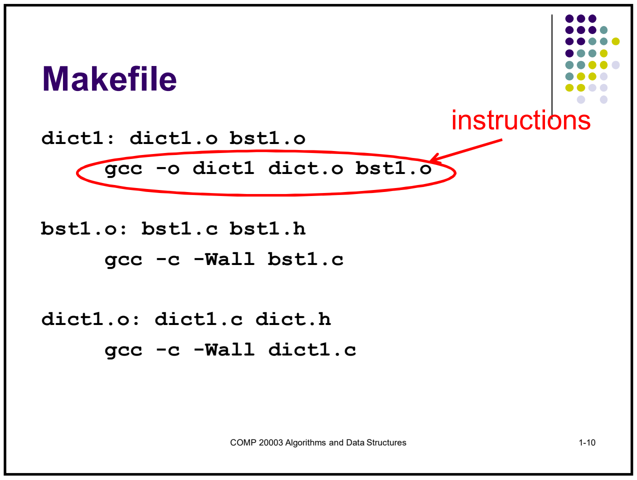
```

dependencies



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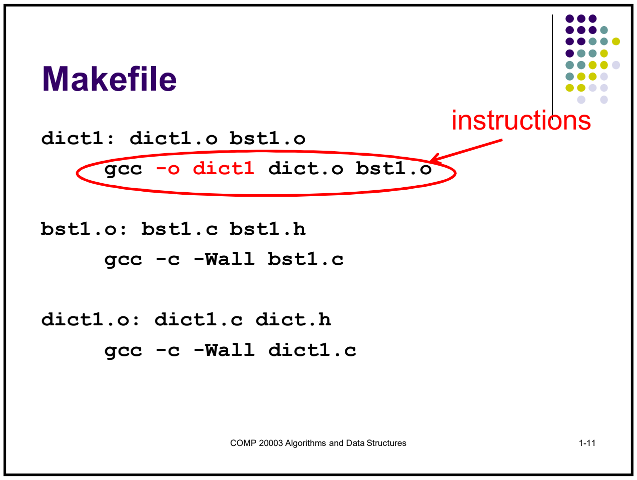
dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c
```

instructions



Makefile

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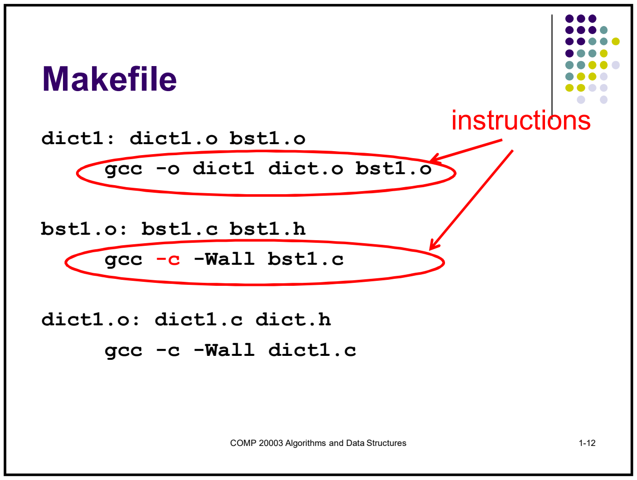
bst1.o: bst1.c bst1.h
     gcc -c -Wall bst1.c

dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c
```

instructions



Makefile

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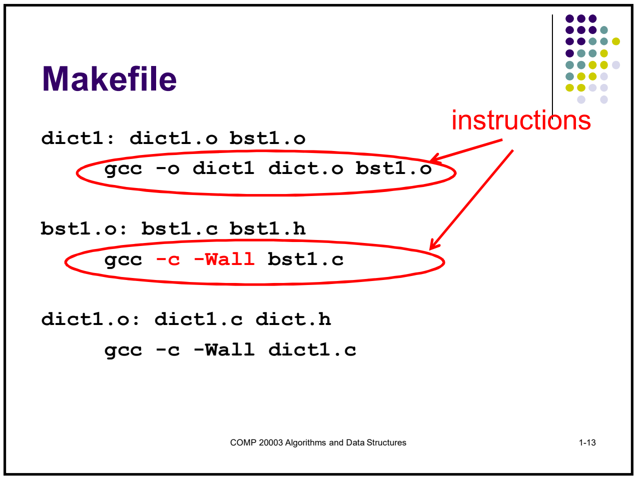
dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c
```

instructions



Makefile

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dict1.o: dict1.c dict.h
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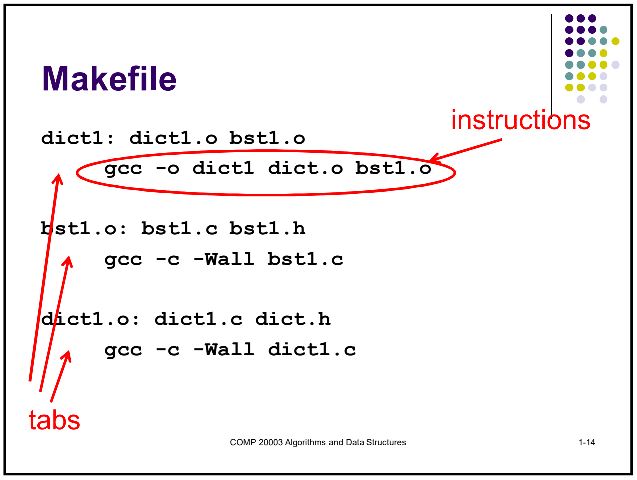
```

instructions



Makefile

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dict1: dict1.o bst1.o
     gcc -o dict1 dict.o bst1.o

bst1.o: bst1.c bst1.h
     gcc -c -Wall bst1.c

dict1.o: dict1.c dict.h
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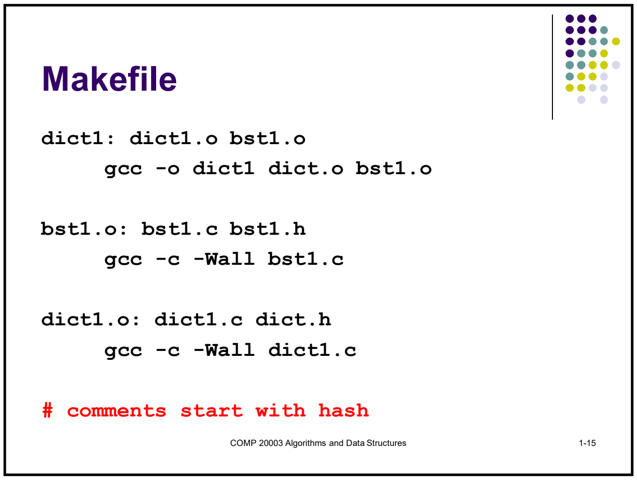
```

instructions

tabs



Makefile

```
dict1: dict1.o bst1.o
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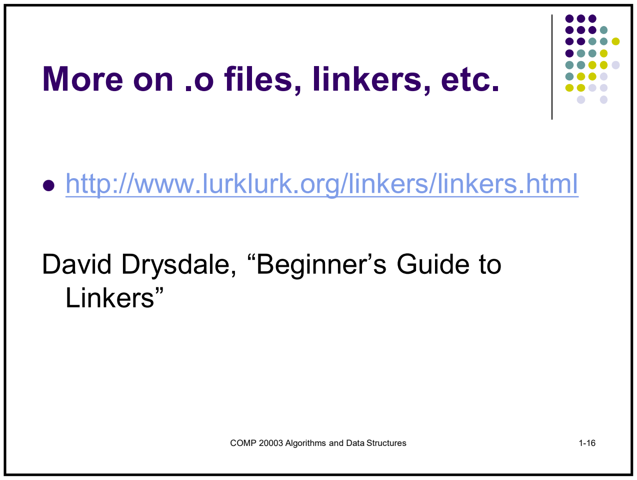
bst1.o: bst1.c bst1.h
     gcc -c -Wall bst1.c

dict1.o: dict1.c dict.h
     gcc -c -Wall dict1.c

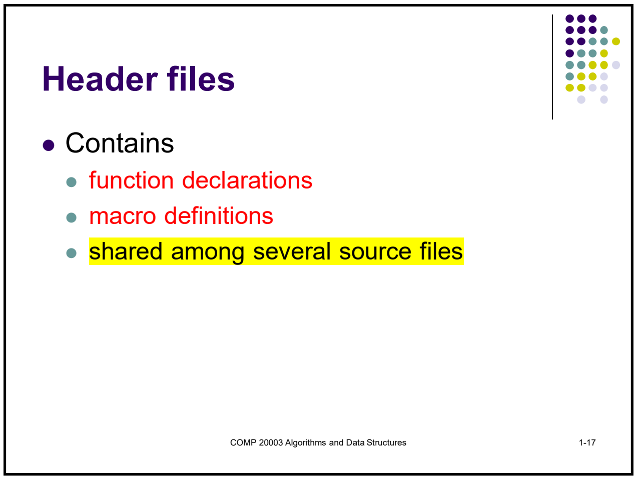
# comments start with hash
```



More on .o files, linkers, etc.

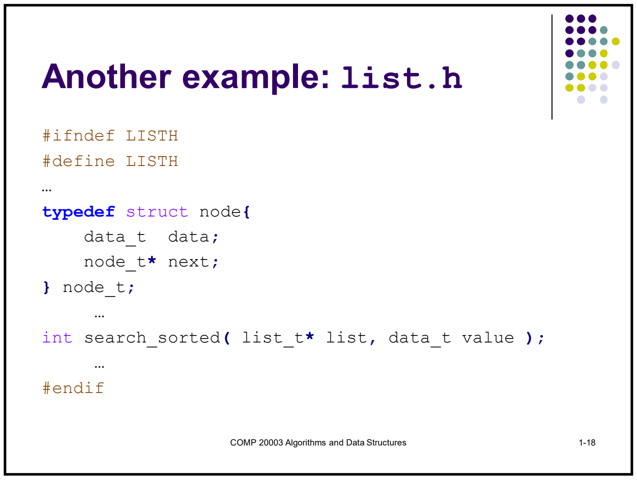
- http://www.lurklurk.org/linkers/linkers.html

David Drysdale, “Beginner’s Guide to Linkers”



Header files

- Contains
  - function declarations
  - macro definitions
  - shared among several source files



Another example: `list.h`

```
#ifndef LISTH
#define LISTH
…
typedef struct node{
    data_t  data;
    node_t* next;
} node_t;
     …
int search_sorted( list_t* list, data_t value );
     …
#endif
```