

# CSc 352

# Make

Benjamin Dicken

# Make

- Talked some about make before
- Let's cover a few more details

# Make Terminology

- **Rule:** A specification of command(s) to run in order to generate a particular **target** file given zero or more **prerequisites**
- **Target:** One of the files that we want this make file to be able to generate as output (often an executable or .o file)
  - The target name does not \*have\* to be a file name (for example, clean)
- **Prerequisite:** A file that one of the **target**'s depends on existing and being up-to-date in order to create

# Make Dependencies

- Make is more than just a way to save time typing out **gcc** commands in the terminal
- Also *manages dependencies* for large projects

```
$ ls
```

```
game.c
```

```
sport.c
```

```
sport.h
```

```
calc.c
```

```
calc.h
```

```
makefile
```

game: game.c sport.o sport.h calc.o calc.h

```
gcc -Wall -Werror -std=c11 game.c calc.o sport.o -o game
```

sport.o: sport.c sport.h

```
gcc -Wall -Werror -std=c11 -c sport.c -o sport.o
```

calc.o: calc.c calc.h

```
gcc -Wall -Werror -std=c11 -c calc.c -o calc.o
```

clean:

```
rm -rf game calc.o sport.o
```

calc.h

sport.h

game

calc.c

calc.o

sport.c

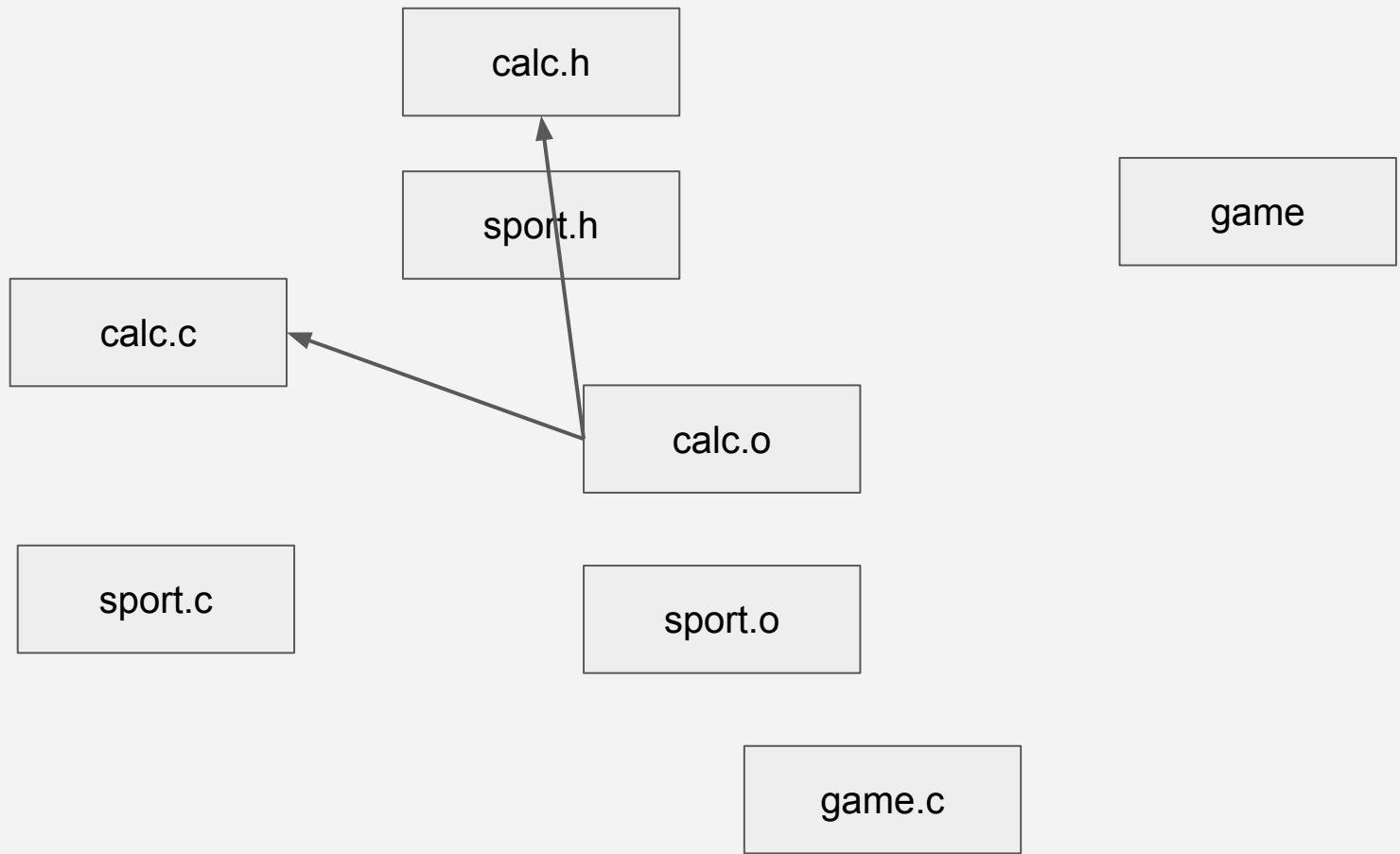
sport.o

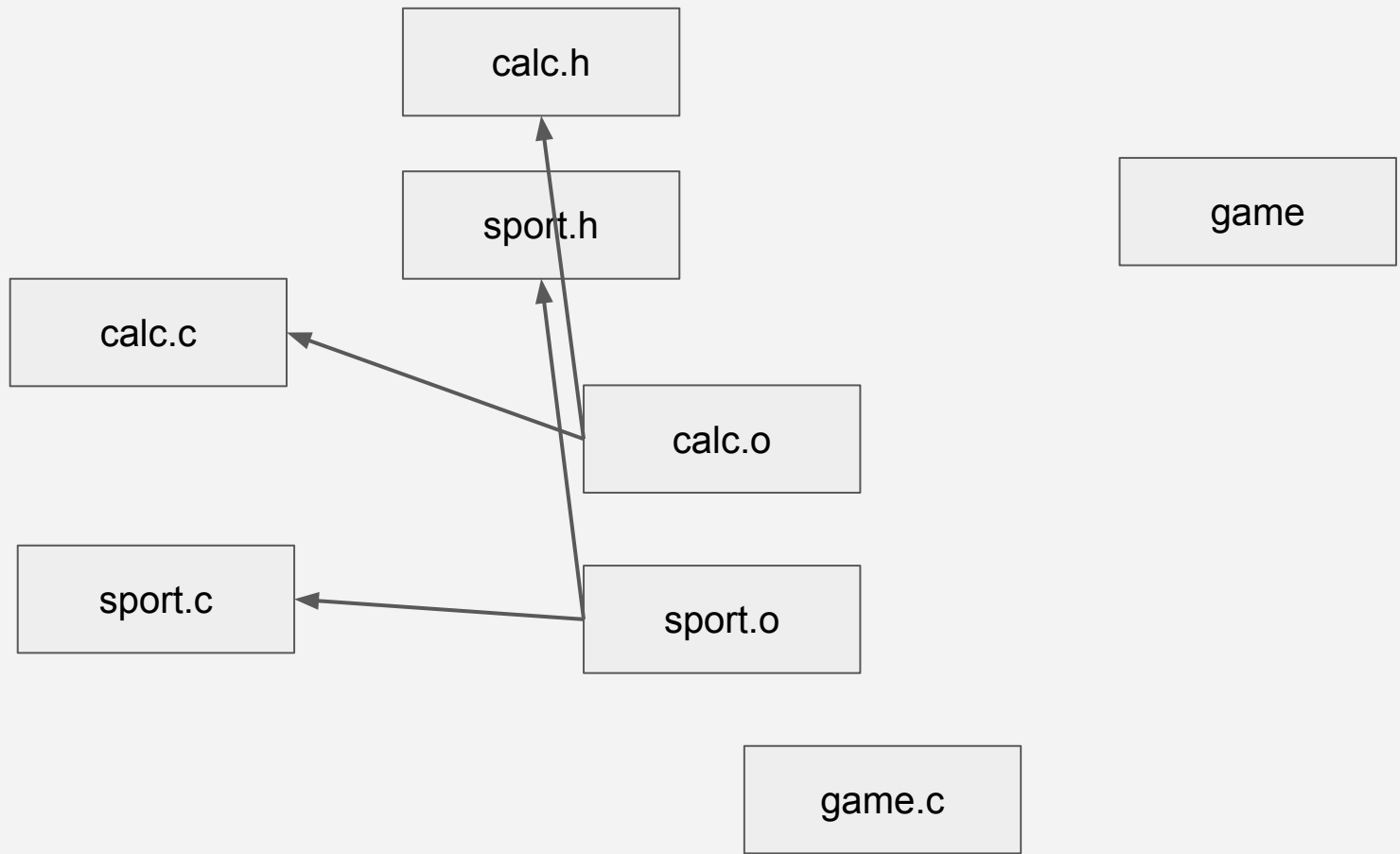
game.c

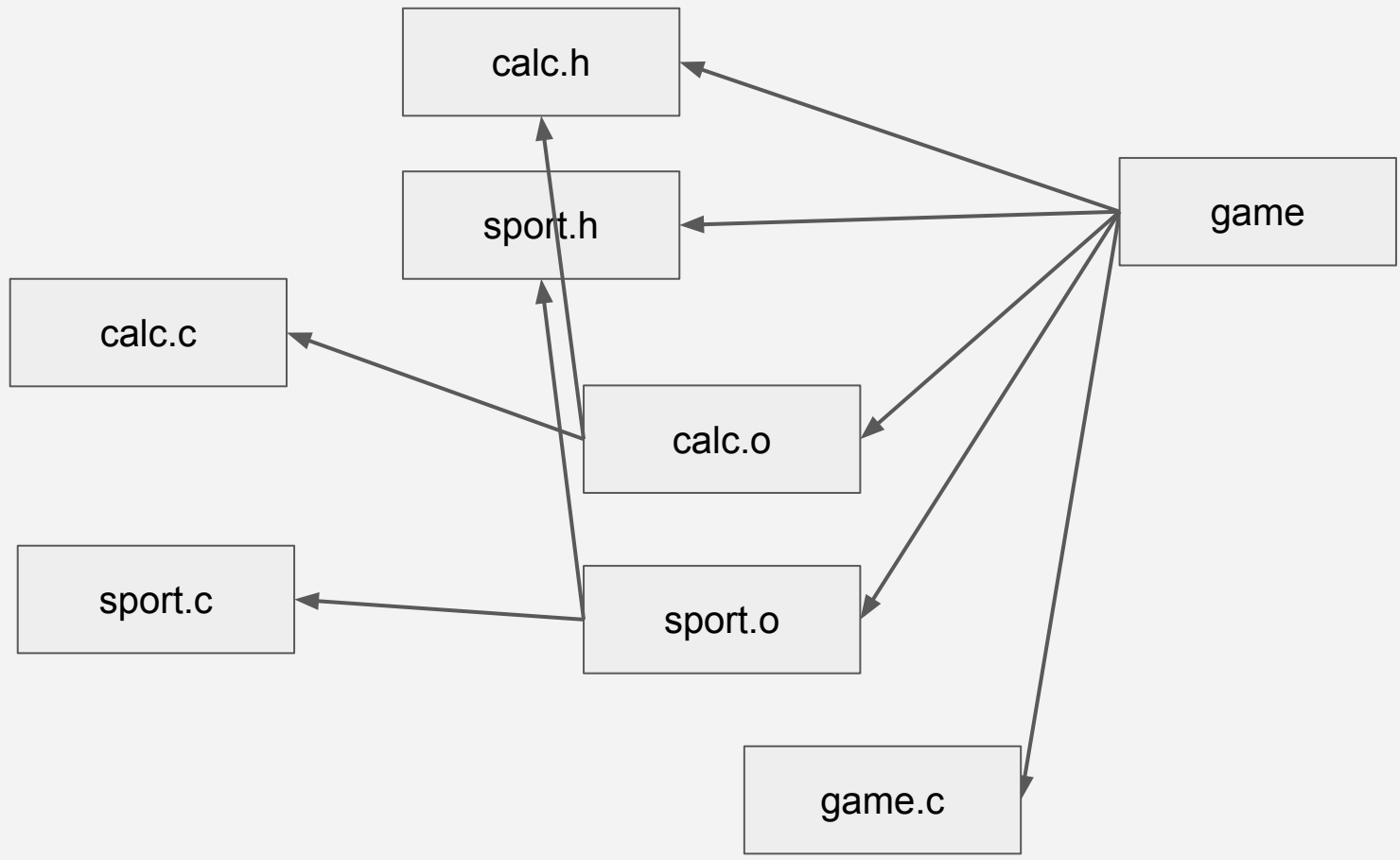


Draw the  
dependency  
graph









# Modified Time

The make utility utilizes file metadata to help with this!

(Last modified time)

```
game: game.c sport.o sport.h calc.o calc.h
```

```
gcc -Wall -Werror -std=c11 game.c calc.o sport.o -o game
```

```
sport.o: sport.c sport.h
```

```
gcc -Wall -Werror -std=c11 -c sport.c -o sport.o
```

```
calc.o: calc.c calc.h
```

```
gcc -Wall -Werror -std=c11 -c calc.c -o calc.o
```

```
clean:
```

```
rm -rf game calc.o sport.o
```

How could this be modified to be shorter or simpler?

## These look pretty similar

game: game.c sport.o sport.h calc.o calc.h

gcc ~~-Wall -Werror -std=c11~~ game.c calc.o sport.o -o game

sport.o: sport.c sport.h

gcc ~~-Wall -Werror -std=c11~~ -c sport.c -o sport.o

calc.o: calc.c calc.h

gcc ~~-Wall -Werror -std=c11~~ -c calc.c -o calc.o

clean:

rm -rf game calc.o sport.o

game: game.c sport.o sport.h calc.o calc.h

```
gcc -Wall -Werror -std=c11 game.c calc.o sport.o -o game
```

**%.o: %.c**

```
gcc -Wall -Werror -std=c11 -c $< -o $@
```

clean:

```
rm -rf game calc.o sport.o
```


calc.o: calc.h

sport.o: sport.h

## Repetitive arguments

```
game: game.c sport.o sport.h calc.o calc.h
    gcc -Wall -Werror -std=c11 game.c calc.o sport.o -o game
%.o: %.c
    gcc -Wall -Werror -std=c11 -c $< -o $@
clean:
    rm -rf game calc.o sport.o

calc.o: calc.h
sport.o: sport.h
```





```
gcc_args = -Wall -Werror -std=c11
```

```
game: game.c sport.o sport.h calc.o calc.h
```

```
    gcc $(gcc_args) game.c calc.o sport.o -o game
```

```
%.o: %.c
```

```
    gcc $(gcc_args) -c $< -o $@
```

```
clean:
```

```
    rm -rf game calc.o sport.o
```

```
calc.o: calc.h
```

```
sport.o: sport.h
```

# Further Reading

[https://www.gnu.org/software/make/manual/html\\_node/index.html](https://www.gnu.org/software/make/manual/html_node/index.html)

## Fix the program

- COPY the files in `/tmp/352cptest` to your home directory  
`$ cp -r /tmp/352cptest ~/`
- Compile the code with **make**
- What do you see?
- How can you fix it using the preprocessor?