

# Make

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CS 491B  
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## Why use Make?

- Used primarily for C/C++ programs
- Can be used to automate repetitive tasks such as compiling or generating files

## Compiling C++ Programs

```
g++ -o cardgame main.cpp cards.cpp  
graphics.cpp
```

- Takes a long time to compile
- Not practical for large programs

## Compiling by Parts

```
g++ -c main.cpp  
Generates file main.o  
g++ -c cards.cpp  
g++ -c graphics.cpp  
Generates cards.o, graphics.o  
g++ -o cardgame main.o cards.o graphics.o  
Links them together
```

## Multi File Programs

- For large programs, each source file can be compiled into its own object file.
- Only the source files that get changed need to be recompiled.
- After compilation, the object files are linked together to create the final executable.

## Makefile

Basic format:

```
target: dependencies  
final build commands
```

space  
tab

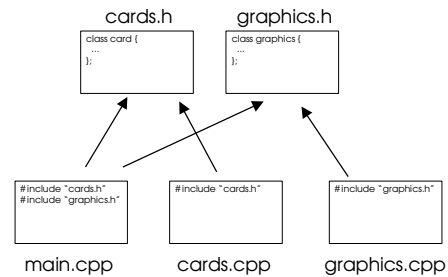
- Example:  
cardgame:  
g++ -o cardgame main.cpp cards.cpp graphics.cpp

- Modification time of dependencies is checked first, if so the build commands are run.
- Other rules can be used as dependencies.

## Common Targets

- clean
  - Clean up object files.
- install
  - Installation script for the compiled program.
- dist
  - Create distribution bundle (tar or zip).

## Dependencies



## Makefile with Dependencies

```
cardgame: main.o cards.o graphics.o
    g++ -o cardgame main.o cards.o graphics.o
main.o:      main.cpp cards.h graphics.h

cards.o:     cards.cpp cards.h

graphics.o:  graphics.cpp graphics.h
```

- The 'makedepend' program can generate these dependencies automatically.

## Variable Substitution

```
OBJS = main.o cards.o graphics.o

cardgame: $(OBJS)
    g++ -o cardgame $(OBJS)
```

## Common Variables

- \$CC
  - C compiler used (cc or gcc)
- \$CFLAGS
  - Special flags for compiler (-O, -W etc)
- \$VPATH
  - Directories to search for source files
- \$COMPILE.(extension)
  - Command used to compile 'extension' files
- \$@
  - Substitute with target name
- \$<
  - Substitute with dependencies

## Revised Makefile

```
CC = g++
CFLAGS = -W -O
OBJS = main.o cards.o graphics.o

cardgame: $(OBJS)
    $(CC) $(CFLAGS) -o $@ $(OBJS)
```

## Different Targets

- Convert latex to pdf:

```
.tex.dvi:  
  latex $<
```

```
.dvi.pdf:
```

```
  dvi2pdf $< -o $@
```

- Convert bmp to png:

```
.bmp.png:
```

```
  bmp2png $< -O $@
```