Document Details

Name: Learn To Use Makefile

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Demo Make

Utility ‘make’ is the first successful and widely accepted command line build automation tool. For a project it is always the case that multiple developers will work on multiple source and header files. Building and testing even a small change is frequent requirement during development.

```
objects = main.o kbd.o command.o display.o \
          insert.o search.o files.o utils.o

edit : $(objects)
        cc -o edit $(objects)

main.o : defs.h
kbd.o : defs.h command.h
command.o : defs.h command.h
display.o : defs.h buffer.h
insert.o : defs.h buffer.h
search.o : defs.h buffer.h
files.o : defs.h buffer.h command.h
utils.o : defs.h

.PHONY : clean
clean :
        rm edit $(objects)
```

Image Source: https://www.gnu.org/software/make/manual/html_node/make-Deduces.html#make-Deduces

Descenders are ant, maven, etc. Now we have in the market CICD (Continuous Integration Continuous Development) and GUI tools like Jenkins.

Make

Terminology:

A Rule looks like below,

target … : prerequisites …

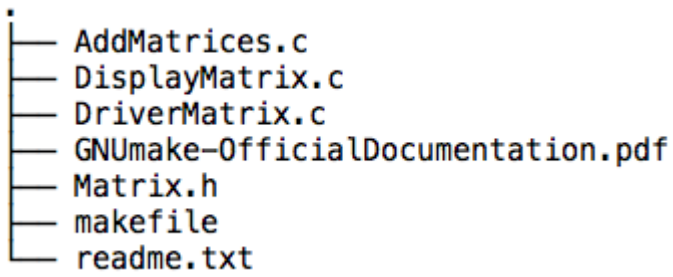
    recipe

    …

    …

The first rule target is also known as goal.

For the folder content, use following command sequence after understanding the purpose.



(1) Below -n option, shows the recipe to be run on target named clean. Also may use option --dry-run

>make -n clean

>ls

(2) Below actually runs the recipe of target clean directly. Note that there are no prerequisites to process for target named clean.

>make clean

>ls

(3) Default goal is all as it is the first target. make command by default runs file named makefile default target. make or 'make all' is one and the same. Note that the prerequisites are also processed if not already. Note that object files are generated and

finally linked as runme executable file. You may test it. It shall show sample resulting matrix.

>make

>ls

>./runme

Optionally, may clean up using 'make clean' command now.

(4) Update any single or more source/header file(s) content or just timestamp modification using touch command. And run make to notice that it behaves smart via running only those targets which are affected.

> touch AddMatrices.c

> ls -lt

> make -n all

> make all

> ls -lt

Directory Files Content and run log on macOS High Sierra Version 10.13.4 (17E199) using script command:

```
Script started on Thu Jun 14 13:07:07 2018
bash-3.2$ pwd
/Users/DemoUser/Desktop/StepAheadWithC/LearnToUseMake
bash-3.2$ tree .
.
├── AddMatrices.c
├── DisplayMatrix.c
├── DriverMatrix.c
├── GNUmake-OfficialDocumentation.pdf
├── Matrix.h
├── makefile
├── readme.txt
└── typescript

0 directories, 8 files
bash-3.2$ cat DriverMatrix.c
/*
Driver program for using my matrix library
DriverMatrix.c
*/

#include <stdio.h>
#include "Matrix.h"
#define R 3
#define C 3
int main()
{
        int     m1[R][C]={{1,2,3},{4,5,6},{7,8,9}},
                m2[R][C]={{11,12,13},{14,15,16},{17,18,19}},
                m[R][C],
                status
        ;
        /*
        int i,j;
        printf("Please, enter two %dx%d matrices ",R,C);
        for(i=0;i<R;i++)
```

```
	{
		for(j=0;j<C;j++)
		{
			scanf("%d",&m1[i][j]);
		}
	}
	for(i=0;i<R;i++)
	{
		for(j=0;j<C;j++)
		{
			scanf("%d",&m2[i][j]);
		}
	}*/


	status=addmatrices(m1,m2,m);

	if(status==0)
	{
		printf("\n Addition of two matrices\n");
		displaymatrix(m);
	}
	else
		printf("Two matrices of different size can not be added.");

	return 0;
}
bash-3.2$ cat Matrix.h
//Matrix.h
#define R 3
#define C 3
int addmatrices(int [][C], int [][C], int [][C]);
void displaymatrix(int m[][C]);
bash-3.2$ cat AddMatrices.c
#define R 3
#define C 3
int addmatrices(int m1[][C],int m2[][C],int m[][C])
{
	int i,j;

	for(i=0;i<R;i++)
	{
		for(j=0;j<C;j++)
```

```
                {
                        m[i][j]=m1[i][j]+m2[i][j];
                }
        }
        return 0; //success
}
bash-3.2$ cat DisplayMatrix.c
#include <stdio.h>
#define R 3
#define C 3
void
displaymatrix(int m[][C])
{
        int             i       , j;
        for (i = 0; i < R; i++) {
                for (j = 0; j < C; j++) {
                        printf("%5d", m[i][j]);
                }
                printf("\n");
        }
}
bash-3.2$ cat makefile
#Compiling with -c option generates independant binary object file which can be shared with others.
all: runme

runme : DriverMatrix.o AddMatrices.o DisplayMatrix.o
         gcc -o runme Addmatrices.o DisplayMatrix.o DriverMatrix.o


DriverMatrix.o : DriverMatrix.c Matrix.h
        gcc -Wall -c DriverMatrix.c -o DriverMatrix.o

AddMatrices.o : AddMatrices.c
        gcc -c AddMatrices.c -o AddMatrices.o

DisplayMatrix.o : DisplayMatrix.c
        gcc -c DisplayMatrix.c -o DisplayMatrix.o

.PHONY : clean
clean:
        rm -rf *.o
        rm -rf runme
```

```
bash-3.2$ make -n clean
rm -rf *.o
rm -rf runme
bash-3.2$ ls
AddMatrices.c                           Matrix.h
DisplayMatrix.c                         makefile
DriverMatrix.c                          readme.txt
GNUmake-OfficialDocumentation.pdf       typescript
bash-3.2$ make clean
rm -rf *.o
rm -rf runme
bash-3.2$ ls
AddMatrices.c                           Matrix.h
DisplayMatrix.c                         makefile
DriverMatrix.c                          readme.txt
GNUmake-OfficialDocumentation.pdf       typescript
bash-3.2$ make
gcc -Wall -c DriverMatrix.c -o DriverMatrix.o
gcc -c AddMatrices.c -o AddMatrices.o
gcc -c DisplayMatrix.c -o DisplayMatrix.o
gcc -o runme Addmatrices.o DisplayMatrix.o DriverMatrix.o
bash-3.2$ ls
AddMatrices.c                           GNUmake-OfficialDocumentation.pdf
AddMatrices.o                           Matrix.h
DisplayMatrix.c                         makefile
DisplayMatrix.o                         readme.txt
DriverMatrix.c                          runme
DriverMatrix.o                          typescript
bash-3.2$ ./runme

 Addition of two matrices
   12   14   16
   18   20   22
   24   26   28
bash-3.2$ touch AddMatrices.c
bash-3.2$ ls -lt
total 3184
-rw-r--r--  1 DemoUser  staff     3414 Jun 14 13:09 typescript
-rwxrwxrwx  1 DemoUser  staff      194 Jun 14 13:09 AddMatrices.c
-rw-r--r--  1 DemoUser  staff        0 Jun 14 13:09 AddMatrices.
-rw-r--r--  1 DemoUser  staff      880 Jun 14 13:09 DisplayMatrix.o
-rwxr-xr-x  1 DemoUser  staff     8700 Jun 14 13:09 runme
-rw-r--r--  1 DemoUser  staff      760 Jun 14 13:09 AddMatrices.o
```

```
-rw-r--r--  1 DemoUser  staff     1556 Jun 14 13:09 DriverMatrix.o
-rw-r--r--@ 1 DemoUser  staff      228 Jun 14 09:56 readme.txt
-rw-r--r--  1 DemoUser  staff      516 Jun 14 09:10 makefile
-rw-r--r--@ 1 DemoUser  staff  1574458 Jun 14 09:04 GNUmake-OfficialDocumentation.pdf
-rwxrwxrwx  1 DemoUser  staff      678 Jun 14 08:57 DriverMatrix.c
-rwxrwxrwx  1 DemoUser  staff      117 Jun 14 08:46 Matrix.h
-rw-r--r--  1 DemoUser  staff      205 Jun 14 01:16 DisplayMatrix.c
bash-3.2$ make -n all
gcc -c AddMatrices.c -o AddMatrices.o
gcc -o runme Addmatrices.o DisplayMatrix.o DriverMatrix.o
bash-3.2$ make all
gcc -c AddMatrices.c -o AddMatrices.o
gcc -o runme Addmatrices.o DisplayMatrix.o DriverMatrix.o
bash-3.2$ ls -lt
total 3184
-rw-r--r--  1 DemoUser  staff      760 Jun 14 13:09 AddMatrices.o
-rwxr-xr-x  1 DemoUser  staff     8700 Jun 14 13:09 runme
-rw-r--r--  1 DemoUser  staff     3414 Jun 14 13:09 typescript
-rwxrwxrwx  1 DemoUser  staff      194 Jun 14 13:09 AddMatrices.c
-rw-r--r--  1 DemoUser  staff        0 Jun 14 13:09 AddMatrices.
-rw-r--r--  1 DemoUser  staff      880 Jun 14 13:09 DisplayMatrix.o
-rw-r--r--  1 DemoUser  staff     1556 Jun 14 13:09 DriverMatrix.o
-rw-r--r--@ 1 DemoUser  staff      228 Jun 14 09:56 readme.txt
-rw-r--r--  1 DemoUser  staff      516 Jun 14 09:10 makefile
-rw-r--r--@ 1 DemoUser  staff  1574458 Jun 14 09:04 GNUmake-OfficialDocumentation.pdf
-rwxrwxrwx  1 DemoUser  staff      678 Jun 14 08:57 DriverMatrix.c
-rwxrwxrwx  1 DemoUser  staff      117 Jun 14 08:46 Matrix.h
-rw-r--r--  1 DemoUser  staff      205 Jun 14 01:16 DisplayMatrix.c
bash-3.2$ exit

Script done on Thu Jun 14 13:10:06 2018
```