• # for preprocessor
• indicates where to look for printf() function
• .h file is a header file

```
#include <stdio.h>

int main(void)
{
    printf("Hello, world!₩n");
    return 0;
}
```

•entry point
•called on program start
•only one main( ) in any program

• belongs to stdio.h
• “Hello….” is a parameter to printf()

Marathon Distance Program

- convert the distance to kilometers
  - 1 mile = 1.609 km = 1760 yards
  - we know that the marathon length is 26 miles and 385 yards, then what is it in kilometers?
    - the answer is 42.185968

```
/* The distance of a marathon in kilometers. */

#include <stdio.h>

int main(void)
{
    int     miles, yards;
    float   kilometers;

    miles = 26;
    yards = 385;
    kilometers = 1.609 * (miles + yards / 1760.0);
    printf(“₩nA marathon is %f kilometers.₩n₩n", kilometers);
    return 0;
}
```

comment

declaration of variables

assignment

expression

Preprocessor

- performs before compilation
- # indicates that this line is a directive

- #define for symbolic constants

```
#define  PI   3.141592
#define  YARDS_PER_MILE        1760
```

- #include <file-name> imports a header file from some where
- #include "file-name" from your directory

```
#include <stdio.h>

#define   AREA                          2337
#define   SQ_MILES_PER_SQ_KILOMETER     0.3861021585424458
#define   SQ_FEET_PER_SQ_MILE           (5280 * 5280)
#define   SQ_INCHES_PER_SQ_FOOT         144
#define   ACRES_PER_SQ_MILE             640
```

pacific_sea.h

```
/* Measuring the Pacific Sea. */

#include "pacific_sea.h"

int main(void)
{
   const int   pacific_sea = AREA;     /* in sq kilometers */
   double      acres, sq_miles, sq_feet, sq_inches;

   printf("₩nThe Pacific Sea covers an area");
   printf(" of %d square kilometers.₩n", pacific_sea);
   sq_miles = SQ_MILES_PER_SQ_KILOMETER * pacific_sea;
```

pacific_sea.c

I/O Using stdio.h

- printf(“any string or characters %d %f”, a, b);
  - “ “ indicates a format to be displayed
  - % is followed by a single character for a format
    - c (char), d (decimal), e (exponential), f(floating), s (string)
  - escape with ₩
    - ₩n, ₩t, ₩”, ₩₩
- scanf(“%d”, &age);
  - takes something from the standard input, and interpret as a decimal

```
#include <stdio.h>

int main(void)
{
   char      c1, c2, c3;
   int       i;
   float     x;
   double    y;

   printf("₩n %s ₩n %s",   "Input three characters,"
            "an int, a float, and a double:  ");

   scanf("%c %c %c %d %f %lf", &c1, &c2, &c3, &i, &x, &y);

   printf("₩nHere is the data that you typed in:₩n");
   printf("%3c%3c%3c%5d%17e%17e₩n₩n", c1, c2, c3, i, x, y);
   return 0;
}
```

Control Flow

- each statement is executed one by one sequentially

- special statements change the flow
  - if (expr) a single statement OR { statements }
  - while (expr) a single statement OR
  - for (expr1; expr2; expr3) a single statement OR

```
expr1;
while (expr2)  {
   statement
   expr3;
}
```

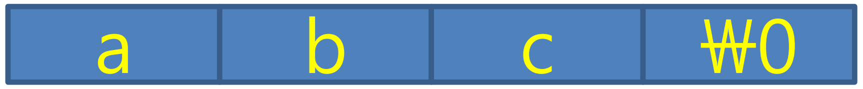
```
#include <stdio.h>

int main(void)
{
    int    i = 1, sum = 0;

    while (i <= 5) {
        sum += i;
        ++i;
    }
    printf("sum = %d₩n", sum);
    return 0;
}
```

Arrays

- deal with multiple same type data
- int xxx[3];
  - declares 3 integers; xxx[0], xxx[1], xxx[2]

```
int i;
i = 2;
xxx[i] = xxx[0] + 79;
```

- a string "abc"



Pointer

- address is a location in the imaginary space
  - an array name

```
int age[100];
```

```
char *p;
int *pq;
```

Functions

- Can you write a program of 10,000 lines in a single file?
  - divide your whole code into many small chunks
  - some chunks may look similar
    - make them into a single one; how?
    - this is a function
- main() is a special function called by ….

```c
#include <stdio.h>

float   maximum(float x, float y);
float   minimum(float x, float y);
void    prn_info(void);

int main(void)
{
    int      i, n;
    float    max, min, x;

    prn_info();
    printf("Input n:  ");
    scanf("%d", &n);
    printf("₩nInput %d numbers:", n);
    scanf("%f", &x);
    max = min = x;
    for (i = 2; i <= n; ++i) {
        scanf("%f", &x);
        max = maximum(max, x);
        min = minimum(min, x);
    }
}
```

```c
float maximum(float x, float y)
{
    if (x > y)
        return x;
    else
        return y;
}

float minimum(float x, float y)
{
    if (x < y)
        return x;
    else
        return y;
}

void prn_info(void)
{
    printf("₩n%s₩n%s₩n₩n",
        "This program reads an integer value
for n, and then",
        "processes n real numbers to find
max and min values.");
}
```

```
#include <stdio.h>

int main(void)
{
   int     a = 1;
   void    try_to_change_it(int);

   printf("%d₩n", a);      /* 1 is printed */
   try_to_change_it(a);
   printf("%d₩n", a);      /* 1 is printed again! */
   return 0;
}

void try_to_change_it(int a)
{
   a = 777;
}
```

Files

- you need files, believe me.
- xfp = fopen(“file-name”, “r”);
  - checks if the file is available
  - prepares a pointer, xfp, to a location inside a file
- now read from (write to) the file using the pointer

```
        c = getc(xfp);
        n = fscanf, “%d %d %f %s”, i, j, x, name);
```

```
/* Count uppercase letters in a file. */

#include <stdio.h>
#include <stdlib.h>

int main(int argc, char *argv[])
{
   int     c, i, letter[26];
   FILE    *ifp, *ofp;

   ifp = fopen(argv[1], "r");
   ofp = fopen(argv[2], "w");
   for (i = 0; i < 26; ++i)        /* initialize array to zero */
      letter[i] = 0;
   while ((c = getc(ifp)) != EOF)
      if (c >= 'A' && c <= 'Z')      /* find uppercase letters */
         ++letter[c - 'A'];
   for (i = 0; i < 26; ++i) {                    /* print results */
      if (i % 6 == 0)
         putc('₩n', ofp);
      fprintf(ofp, "%c:%5d      ", 'A' + i, letter[i]);
   }
   putc('₩n', ofp);
   return 0;
}
```