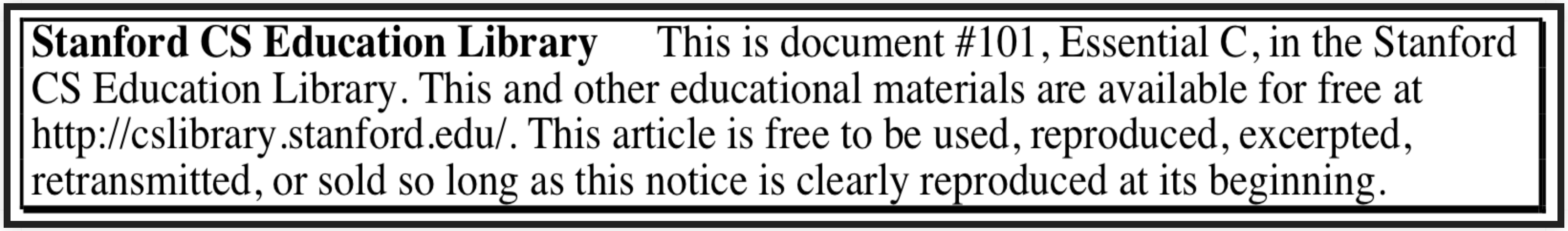
Miscellaneous

Stat 580: Statistical Computing

- Theme: Black - White
- Printable version

References

- Part of this slide set is based on *Essential C* by Nick Parlante:



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Structures

Structures

- declaration such as `struct xxx` define a new type

```c
struct fraction {
int numerator;
int denominator;
};
```

- C uses the period (`.`) to access the fields in a record

```c
struct fraction f1;
f1.numerator = 1;
```

- you can copy two records of the same type using a single assignment statement
- however == does not work on structs
- C allows the use of array of structures

Example

```
#include<stdio.h>

struct fraction {
  int numerator;
  int denominator;
};

int main() {
  struct fraction f1, f2;          /* declare two fractions */
  f1.numerator = 22;
  f1.denominator = 7;
  f2 = f1;    /* this copies over the whole struct */
  return 0;
}
```

Example

```c
#include<stdio.h>

struct card {
  int num;
  char *suit;
};
void printcard(struct card c);

int main() {
  struct card c = {1, "diamond"};
  struct card *cp;

  printcard(c);
  cp = &c;
  printcard(*cp);

  /* (*struct_ptr).member is the same as struct_ptr->member */
  printf("%s %d\n", cp->suit, cp->num);
  /* what is *(cp->suit+2) */

  return 0;
}

void printcard(struct card c) {
  printf("%s %d\n", c.suit, c.num);
}
```

Example

```
#include<stdio.h>

struct card {
  int num;
  char *suit;
} cards[52]; /* extern storage class */

void create_cards();
void print_card(struct card c);

int main() {
  create_cards();
  print_card(cards[2]);
  return 0;
}
```

Example

```c
void create_cards(){
  int i, ind;

  for (i=0; i<52; i++) {
    cards[i].num = i % 13 + 1;
    ind = i / 13; /* integer division */
    switch(ind){
      case 0:
        cards[i].suit = "heart";
        break;
      case 1:
        cards[i].suit = "diamond";
        break;
      case 2:
        cards[i].suit = "spades";
        break;
      case 3:
        cards[i].suit = "clubs";
    }
  }
}
```

Command line arguments

Command line arguments

- allow user to specify arguments on the command line
- these arguments are handled using main() function arguments

```
int main(int argc, char *argv[])
```

  - `argc` is the number of arguments on the command line
    - including the name of the program itself
  - `argv` is an array of pointers to the values of the arguments
    - `argv[0]` is the name of the program
    - memory of these values are provided by the operating system
    - these values are treated as string and should be converted (via, e.g. `atoi`, `atof` from C standard library) if a numeric value is desired.

Example

```
#include <stdio.h>

int main(int argc, char *argv[]){
  int i;
  printf("Number of arguments: %d\n", argc);
  printf("Arguments:\n");
  for (i=0; i<argc; i++){
    printf("%s\n", argv[i]);
  }
  return 0;
}
```

Example

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int main(int argc, char *argv[]){
  char word[100];
  int n, i;

  if (argc != 3){
    printf("This program prints a word for n times\n");
    printf("usage: funname word n\n");
    printf("       word: the word that you want to repeat\n");
    printf("       n: number of times\n");
    return 1;
  }

  strcpy(word, argv[1]);
  n = atoi(argv[2]);

  for (i=0; i<n; i++)
    printf("%s\n", word);

  return 0;
}
```

File input and output

File

- data are usually stored in a file on your hard drive
- typical steps:

1. Inclusion of header file: `include <stdio.h>`
2. Declaration: declare a variable of (pointer) type FILE *
3. Connection: establish a connection between the variable and the file on your hard drive (`fopen()`)
4. I/O: perform I/O (`fgetc()`, `fscanf()`, `fputc()`, `fprintf()`)
5. Disconnection: break the connection (`fclose()`)

Example

```
#include <stdio.h>

int main(){
  FILE *f;     /* declaration */
  int x, y;

  f = fopen("abc.txt", "r"); /* connection */

  while(fscanf(f, "%d %d\n", &x, &y)==2)
    printf("%d %d\n", x, y);

  fclose(f);
  return 0;
}
```

abc.txt:

```
1 4
6 7
2 5
23 56
23 45
```

Example

```c
#include <stdio.h>

int main(){
  FILE *f;
  double slen, swid, plen, pwid;
  char species[20];

  f = fopen("iris.csv", "r");

  fscanf(f, "%*[^\n]\n", NULL);
  while(fscanf(f, "%lf,%lf,%lf,%lf,\"%[^\"]\"\n",
               &slen, &swid, &plen, &pwid, species)==5)
    printf("%f, %f, %f, %f, %s\n", slen, swid, plen, pwid, species);
  fclose(f);

  return 0;
}
```

First 5 rows of iris.csv:

```
"Sepal.Length","Sepal.Width","Petal.Length","Petal.Width","Species"
5.1,3.5,1.4,0.2,"setosa"
4.9,3,1.4,0.2,"setosa"
4.7,3.2,1.3,0.2,"setosa"
4.6,3.1,1.5,0.2,"setosa"
```