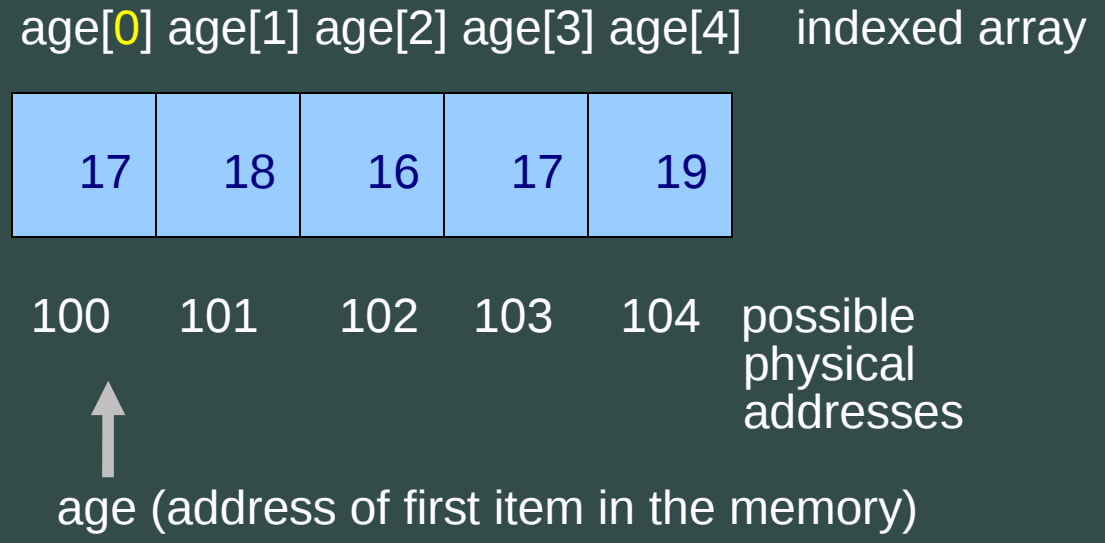
Arrays

- An array is a list of adjacent memory locations whose components have a uniform type

```
int     age[5];
float   weight[15];
char    c[25];
```



Note: Array indices in C always start with 0

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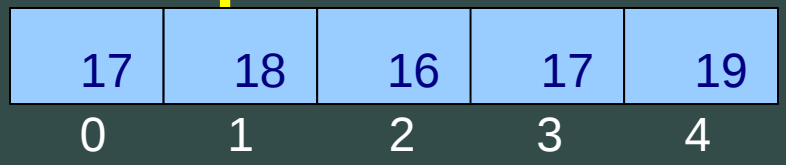
Access of array components

int a[5]; **a**



- Input of values in an array

```
scanf("%d %d %d %d %d\n",
        &a[0], &a[1], &a[2], &a[3], &a[4]);
```

- For larger arrays, a more practical way is by using a loop

```
int  a[500], j;
for ( j=0; j<500; j++ ) {       // input: a[0] ... a[499]
    printf("enter item %d: ", j);
    scanf("%d", &a[j]);
}
```

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Initializing an array (with zeros)

```
// method #1
int x[8] = { 0, 0, 0, 0, 0, 0, 0, 0 };

// method #2
int x[8];
x[0] = x[1] = x[2] = x[3] = x[4] = x[5] = x[6] = x[7] = 0;

// method #3
int x[8], j;
for ( j=0; j<8; j++ ) {
    x[j] = 0;
}
```

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Array indices can be any integer expression within the valid range

```
float  r[10];   // reciprocals 1, 1/2, 1/3, 1/4, ... , 1/10
int      j;

// initialize and print array
for ( j=0; j<10; j++ )  {
    r[j] = (float) 1.0 / (j+1);
    printf("%.2f ", r[j] );
}
// print array values in reverse order
for ( j=0; j<10; j++ )  {
    printf("%.2f ", r[9-j] );
}
```

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When to use arrays?

- When we have large data sets
  - Ex: simple agricultural data (hours of sunlight per day on the growth of 40 plants)
    - float sunlight[40], height[40]
  - Ex: education data (hours spent studying, scores on the first of exam of 100 students)
    - float hours[100], score[100]
- When the data are entered, various statistical procedures can be programmed on the data sets (basic stats like averages, standard deviations; regression and correlation analysis for trends and relationships; etc)

A function to compute the average (arithmetic mean), min and max

```
void stats( int n, float x[ ] )
{   // assumes number of items n > 0:  x[0], x[1], x[2], ... x[n-1]
  int j;
  float sum, min, max;
  sum = min = max = x[0];
  for ( j=1; j<n; j++ )  {
    sum = sum + x[j];
    if (x[j] < min) min = x[j];
    else if (x[j] > max) max = x[j];
  }
  printf ("avg is %f,  min is %f,  max is %f\n", sum/n, min, max);
}
```

This function can be called with different data sets, e.g.,

```
stats(40, sunlight);
stats(40, height);

stats(100, hours);
stats(100, score);
```

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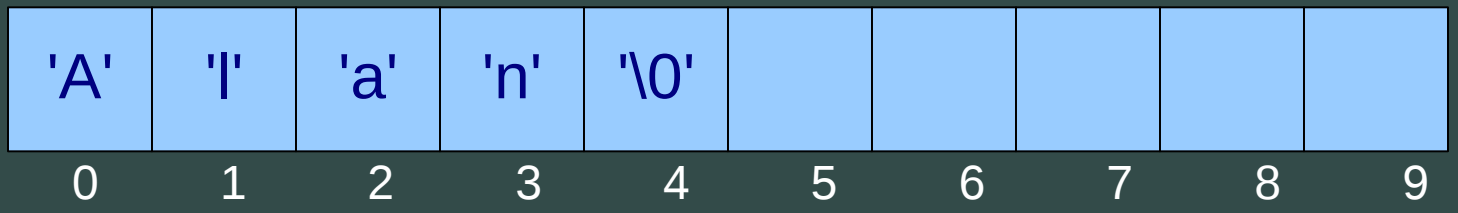
Char strings are also arrays

```
char name[10];
strcpy(name, “Alan”);
```

NULL character
(ASCII code 0)




```
main()
{
   char name[10];
   strcpy(name, “Alan”);
   printstr(name);
}
```

```
void printstr( char s[ ] )
{
    int j;
    for ( j=0; s[j] != '\0';  j++ ) {
        putchar( s[j] );
    }
}
```

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Array names as pointers

- A variable or parameter declared as an array points to the memory location of the first item in the array
- Hence, a function heading like

```
int strlen( char s[ ] )
```

that returns the number of chars in a string s, can also be written as

```
int strlen( char *s )
```

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Some predefined string functions

```
char * strcpy( char *dest, char *source )
// copies the source string to the destination

char * strcat( char *dest, char *source )
// appends the source string to the destination string

int strlen( char *s )
// returns the number of characters in s

int strcmp( char *s, char *t )      or
int strncmp( char *s, char *t, int n )
// returns 0, -1, 1, if s is identical to, before, or after t
// strncmp checks only the first n characters
```

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Working on an array of strings

- A string is an array of chars, so how do we represent an array of strings?

```
main()
{
    char *a[4] = {“Alan”, “Alex”, “Ana”, “Alice”};
    int j;
    for ( j=0; j<4; j++ ) {
        // print only those that start with “Al”
        if ( strncmp( a[j], ”Al”,  2) == 0 )
          printf( “%s has %d chars\n”, a[j], strlen(a[j]) );
    }
}
```

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