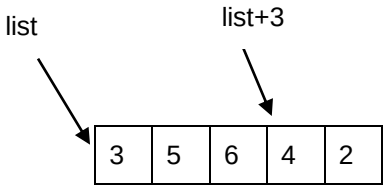
Pointers and One-dimensional Arrays

- Arrays and pointers are closely related in C and may be used almost interchangeably.
- An array name represents the address of the first element of an array.

Example:

```
int list[5] = {3, 5, 6, 4, 2};
```



- The array name `list` is just equivalent to `&list[0]`. To reach to the address of any other element, we can add the subscript of that element to the array name. For example `list+3` represents `&list[3]`.
- We can use the indirection operator to reach to the array elements. For example, both `list[3]` and `*(list+3)` represent the value **4**.

Example: Express 3 in the list

a) `list[0]`

b) `*(list+0) ≡ *list`

Example:

```
char b[50];
char *bptr;
```

- Since the array name without a subscript is a pointer to the first element of the array, we can set `bptr` equal to the address of the first element in array `b` with the statement:

```
bptr = b;
```

This statement is equivalent to taking the address of the first element of the array as follows:

```
bptr = &b[0];
```

- Therefore, to reach to the first element of `b` array, we can use `*bptr`:

```
*bptr = 'A';
```

- What about the following assignment statement?

```
*(bptr + 25) = 'B';
```

- What does the following `printf` statement display?

```
printf ("%c %c %c %c\n", b[0], b[25],*(bptr+25),*bptr + 25);
```

Example: What does the following program display?

```
int main (void)
{  int ref[4] = {14, 8, 22, 5};
   int *refptr;
   int i;
   refptr = ref;
   for (i = 0; i < 4; i++)
   {  printf("%d\t%d\t%d\t", ref[i], *(ref+i), *ref+i);
      printf("%d\t%d\t%d\n", refptr[i], *(refptr+i), *refptr+i);
   }
   return(0);
}
```

Example: Write a function that initializes all elements of a one-dimensional integer array to **n**. Use pointer-notation instead of subscript notation.

```
void initArray (int *ap, int size, int n)
{  int k;
   for (k = 0; k < size; k++)
            *(ap + k) = n;  // ap[k] = n;
}
```

- When we need a one-dimensional array as the parameter of a function, in fact we need its starting address, which is a pointer. So it is possible to declare the `a` array as `int *ap` in the formal parameter list.

Example:

```
char arr[9] = {'H', 'E', 'L', 'L', 'O', ' ', 'A', 'L', 'I' };
int ind;
ind = 0;
while (arr[ind] != ' ')
     ind++;
printf("Number of elements before blank= %d\n", ind);
```

can also be written as

```
char arr[9] = {'H', 'E', 'L', 'L', 'O', ' ', 'A', 'L', 'I' };
char *arrptr;
arrptr = arr;
while (*arrptr != ' ')
     arrptr++;
printf("Number of elements before blank= %d\n", arrptr - arr);
```

- Array subscripting notation is converted to pointer notation during compilation, so writing array subscripting expressions with pointer notation, can save compile time. But array subscripting notation will probably be much clearer.

Example: What does the following program segment display?

```
int a[5] = {2, 5, 8, 9, 3};
int *b;
b = a;
printf("%d\n", b[2]);
*b = 3;
*(b + 2) = 4;
printf("%d %d\n", b[0], b[2]);
printf("%d %d\n", a[0], a[2]);
```

➢ *READ Sec. 7.8 from Deitel & Deitel.*

Home Exercise: What does the following program do? Complete the output.

```
void f (double **p)
{
   (*p)++;
}

int  main (void)
{
   double num[3] = {7.5, 5.0, 2.5};
   double *pp = num;
   printf("%p %0.1f\n", pp, *pp);
   f(&pp);
   printf("%p %0.1f\n", pp, *pp);
   return(0);
}
```

```
0012FF0C  ?

?         ?
```