Pointers

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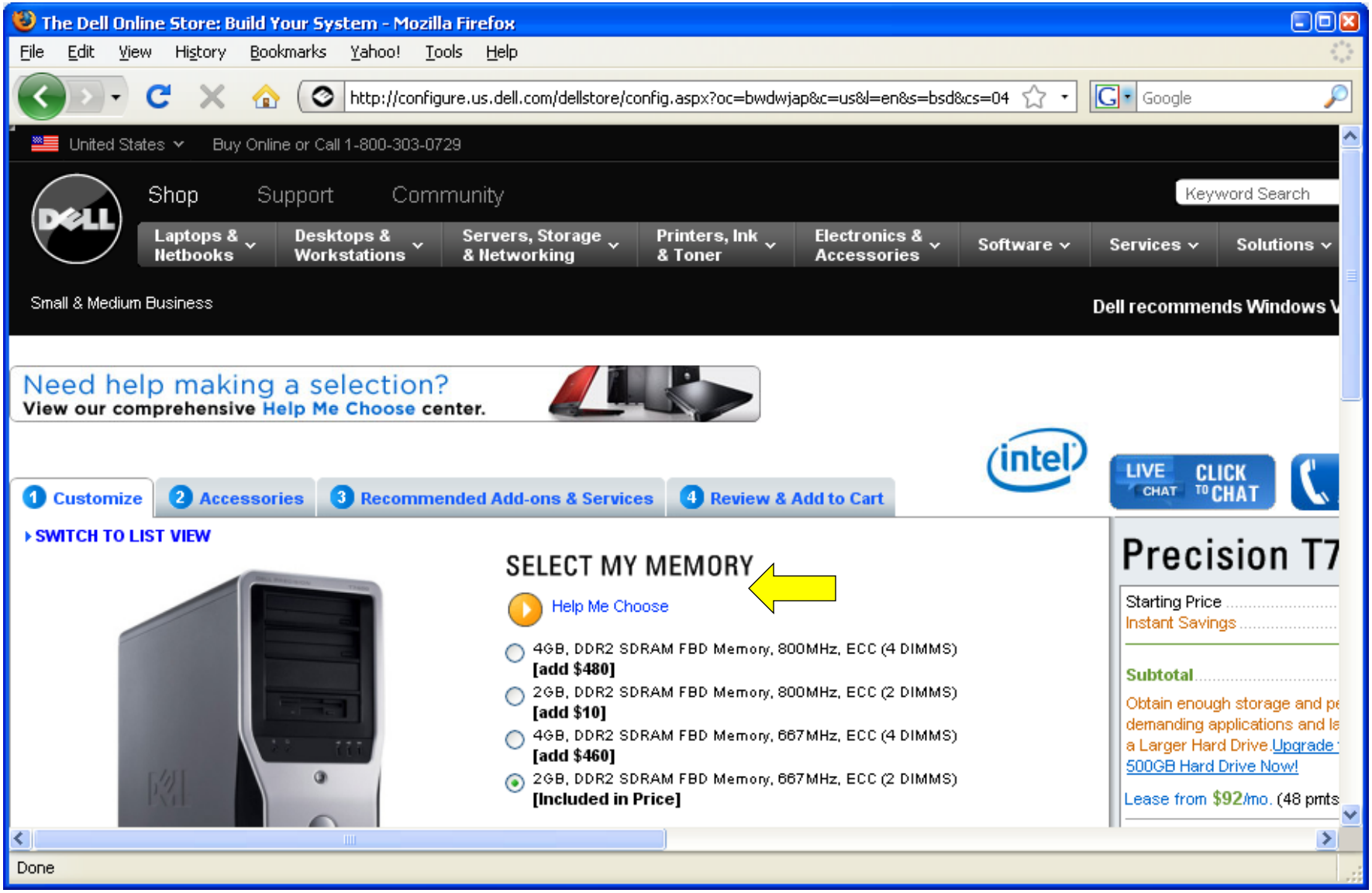
Computer Memory



How is Memory Used?

In a computer, memory is accessed using **addresses**.

Address	**Data**
0X00000000	…
…	…
0x08001F00	‘a’
…	…
0X1A0088F0	642
…	…

How to Find the Address?

int x = 123;

&x /* ampersand */ $\Rightarrow$ address of x

Address	Data
somewhere (&x)	123

A program **cannot** control **where** a variable (such as x) is placed. It is determined by the compiler + run time system. A program can control the value at this address.

x = 654; /* change the value */

Address	Data
somewhere (&x)	654

&x = 90; /* error, cannot change x's address */

Pointer

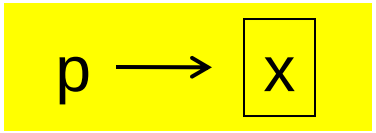
int x = 123;

int * p; /* p is a pointer to an integer */

p = &x; /* p points to x */

& x ⇒ x's address

*p ⇒ value at the address pointed by p; it is 123



Address	**Data**
somewhere (&x)	123
…	…
somewhere (&p)	&x

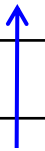
L value and R value

- L value means the left side of an assignment.
- R value means the right side of an assignment.

```
int x = 123;    /* x is L value, 123 is R value */
int y = 987;    /* y is L value */
x = y;          /* x is L value; y is R value */
```

- This means
  - take the **address** of x (somewhere, we cannot control)
  - take the **value** of the address of y
  - assign the value to the address
  - result: x's value is 987.

Address	**Data**
somewhere (&x)	123
…	…
somewhere (&y)	987



Change Values through Pointers

```
int x = 123;
int * p = & x;  /* p points to x */
```

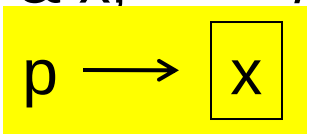
Address	Data
somewhere (&x)	123
…	…
somewhere (&p)	& x

```
*p = 456;
/* take the value of p (x's address) as the address and
    assign 456 to this address; x becomes 456 */
```

Address	Data
somewhere (&x)	456
…	…
somewhere (&p)	& x

Pointer Operation

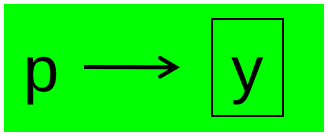
```
int * p;          /* p is a pointer to an integer */
int x = 123;
int y = 987;
p = & x;          /* p points to x */
```




```
*p = 456;         /* x is 456 now */
```

Address	Data
somewhere (&x)	456
…	…
somewhere (&p)	& x
somewhere (&y)	987

```
p = & y;          /* p points to y */
```



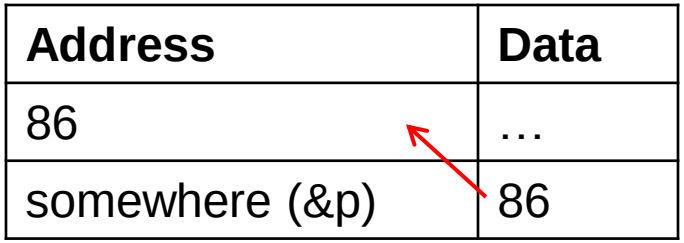

```
*p = -765;        /* y is -765 now */
```

Address	Data
somewhere (&x)	456
…	…
somewhere (&p)	& y
somewhere (&y)	-765

Common Mistake

A program cannot control addresses.

```
65 = 123;
/* cannot assign value 123 to the address 65 */
```




```
int * p = 86;
/* warning message,  the
      address is likely occupied by another program. */

double d = 0.84;
int * p = & d;        /* warning message */
```

Which is correct? You may choose multiple answers.

```
int x = 6543;
int * p = & x;
```

- [ ] A) The value of p is 6543.
- [ ] B) The address of p is 6543.
- [ ] C) The address of x is 6543.
- [x] D) *p = 123 makes x's value 123.
- [ ] E) p = 123 makes x's value 123.
- [ ] F) & p = 123 makes x's value 123.

Correct - Click anywhere to cont

Incorrect - Click anywhere to

Your answer:

You did not answer this question

You must answer the question before continuing

Submit

Clear

Which is correct? You may choose multiple answers.

```
int x = 123;
int y = 567;
int * p = & x;
```

- [ ] A) p = y; makes x's value 567.
- [x] B) p = & y; does not change x's value nor y's value.
- [ ] C) p = y; makes x's value 567.
- [ ] D) y = x; makes x's value 567.
- [ ] E) y = & p; makes y's value 123.

Correct - Click anywhere to cont

Incorrect - Click anywhere to

Your answer:

You did not answer this question

You must answer the question before continuing

Submit

Clear

Pointer

Your Score	{score}
Max Score	{max-score}
Number of Quiz Attempts	{total-attempts}

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