Variable Declaration and Assignment Statement

Programming in C

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• used to store values

- used to store values
- identified by a unique and descriptive variable name

- used to store values
- identified by a unique and descriptive variable name
- has a type

- used to store values
- identified by a unique and descriptive variable name
- has a type
- name of the memory location where the value is stored

Variable naming convention

 starts with a lowercase letter e.g. nVal, fAmount

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- starts with a lowercase letter e.g. nVal, fAmount
- camel-cased
 e.g. nNoOfStudents, fUnitPrice

Variable naming convention

- starts with a lowercase letter e.g. nVal, fAmount
- camel-cased
 e.g. nNoOfStudents, fUnitPrice
- Hungarian notation: an identifier naming convention, where the type of data is indicated in the prefix of the variable name.

Туре	Prefix	Example
char	С	cChoice
int	n	nValue

Туре	Prefix	Example
float	f	fPrice
double	d	dTotal

Variable declaration

• Variables, in C, must declared before first use.

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- When writing a declaration statement, the variable name and the type of data must be indicated.

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- Variables, in C, must declared before first use.
- When writing a declaration statement, the *variable name* and the *type of data* must be indicated.

```
e.g. int nValue;
  float fUnitPrice;
  char cChoice, cAns;
```

depends on the purpose of the variable

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int for whole numbers, like class size, count

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int for whole numbers, like class size, count
float for real numbers, like amount, weight

- depends on the purpose of the variable
 - int for whole numbers, like class size, count
 float for real numbers, like amount, weight
- depends on the range of the data type

depends on the purpose of the variable

int for whole numbers, like class size, count
float for real numbers, like amount, weight

depends on the range of the data type

32
64

Туре	Size(bits)
float	32
double	64

depends on the purpose of the variable

int for whole numbers, like class size, count
float for real numbers, like amount, weight

depends on the range of the data type

Туре	Size (bits)	Туре	Size (bits)		Туре	Size(bits)	
char	8	int	32	_	float	32	
		long	64		double	64	

To compute for the ranges,

	formula, where N is the number of bits		
	minimum value maximum value		
signed type	-2 ^{N-1}	$2^{N-1}-1$	
unsigned type	0	$2^{N}-1$	

Local variables

• Local variables are variables declared within a function or within a block.

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- Block is a sequence of statements grouped together inside a pair of braces: { and }.

Local variables

- Local variables are variables declared within a function or within a block.
- Block is a sequence of statements grouped together inside a pair of braces: { and }.
- The scope of a local variable (lifetime) starts at its declaration, until the end of the block where it is declared.

=

• the assignment operator

- =
- the assignment operator
- assigns a value to a variable

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 - the assignment operator
 - assigns a value to a variable

Assignment Statement Syntax:

```
variable = value_or_expression;
```

=

- the assignment operator
- assigns a value to a variable

Assignment Statement Syntax:

```
variable = value_or_expression;
e.g.
    nValue = 5;
    fAmount = 3.5 * 9 / 3;
    cValue = 'a' + 5;
```

Assignment Operator

highest	()	left to right
	unary +, unary -	right to left
	!	
	%, *, /	left to right
	+, -	left to right
	>, >=, <, <=	left to right
	==, !=	left to right
	&&	left to right
		left to right
	=	right to left

C Operator Precedence Table: https://en.cppreference.com/w/c/language/operator_precedence

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?
A112	?
A113	?
A114	?
A115	?
A 116	?
A117	?
A 118	?
A 119	?
A11A	?
A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

	A111	?
	A 112	?
	A113	?
ess	A 114	?
ddre	A115	?
У Э	A 116	?
memory address	A117	?
ше	A 118	?
	A 119	?
	A11A	?
	A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?	
A112	?	
A113	?	
A114	?	(st
A115	?	storage
A116	?	\sim
A117	?	spaces
A118	?	ces
A 119	?	
A11A	?	
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?	
A 112	?	
A 113	?	
A114	es ?	
A115	/alu	
A 116) eg	
A117	garbage values	
A 118	g ?	
A 119	?	
A11A	?	
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?
A112	?
A113	?
A114	?
A115	?
A116	?
A117	?
A 118	?
A 119	?
A11A	?
A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?
A112	?
A113	?
A114	?
A115	?
A116	?
A117	?
A 118	?
A 119	?
A11A	?
A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?
A112	?
A113	?
A114	?
A115	?
A 116	?
A117	?
A 118	?
A 119	?
A11A	?
A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?
A 112	?
A 113	?
A114	?
A115	?
A 116	?
A117	?
A 118	?
A 119	?
A11A	?
A11B	?

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3;
    return 0;
```

A111	?	
A 112	?	
A 113	?	
A114	?	
A 115	?	
A 116	?	
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
A112
A113
A114
A115
A116
A117
A118
A119
A11A
          ?
A11B
```

nVal

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	?	cAr
A 113	?	
A114	?	
A 115	?	
A 116	?	
A117	?	nVa
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A112	'G'	cAns
A113	?	
A114	?	
A115	?	
A 116	?	
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	'G'	cAns
A 113	?	
A114	?	
A 115	?	
A 116	?	
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	'G'	cAns
A 113	?	fAmt
A114	?	
A 115	?	
A 116	?	
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
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    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	'G'	cAns
A 113	3.500000	fAmt
A114		
A115		
A 116		
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	'G'	cAns
A 113	3.5	fAmt
A114		
A115		
A 116		
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A112	'G'	cAns
A113	-3.5 - 7.0	fAmt
A114		
A115		
A 116		
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A112	'G'	cAns
A113	7.0	fAmt
A114		
A115		
A 116		
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

A111	?	
A 112	'G'	cAns
A 113	7.0	fAmt
A114		
A 115		
A 116		
A117	?	nVal
A 118		
A 119		
A11A		
A11B	?	

```
A111
int main()
                                                   'G'
                                          A112
                                                          cAns
    int nVal;
                                                   7.0
                                          A113
                                                          fAmt.
    char cAns = 'G';
                                          A114
    float fAmt = 3.5;
                                          A115
    fAmt = 7;
                                          A116
    fAmt = fAmt * 1.2; // 7.0 * 1.2
                                          A117
                                                          nVal
                                          A118
    cAns = cAns - 3;
                                          A119
    nVal = nVal - 3:
                                         A11A
                                                    ?
                                          A11B
    return 0;
```

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
           'G'
A112
                     cAns
         <del>7.0</del> 8.4
                     fAmt.
A113
A114
A115
A116
A117
A118
A119
A11A
             ?
A11B
```

nVal

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
          'G'
A112
          8.4
A113
A114
A115
A116
A117
A118
A119
A11A
           ?
A11B
```

cAns

fAmt.

nVal

```
A111
int main()
                                                  'G'
                                         A112
                                                          cAns
    int nVal;
                                                  8.4
                                         A113
                                                          fAmt.
    char cAns = 'G';
                                         A114
    float fAmt = 3.5;
                                         A115
    fAmt = 7;
                                         A116
    fAmt = fAmt * 1.2;
                        // 8.4
                                         A117
                                                          nVal
                                         A118
                        // 'G' - 3
    cAns = cAns - 3;
                                         A119
    nVal = nVal - 3:
                                         A11A
                                                   ?
                                         A11B
    return 0;
```

```
A111
int main()
                                                      'G'
                                            A112
                                                             cAns
    int nVal;
                                                      8.4
                                            A113
                                                             fAmt.
    char cAns = 'G';
                                            A114
    float fAmt = 3.5;
                                            A115
    fAmt = 7;
                                            A116
    fAmt = fAmt * 1.2;
                          // 8.4
                                            A117
                                                              nVal
                                            A118
                          // 'G' - 3
    cAns = cAns - 3;
                                            A119
    nVal = nVal - 3:
                                            A11A
                                            A11B
    return 0;

    ASCII value of 'A' is 65.
```

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
                           // 'D'
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
A112
         <del>'G'</del> 'D'
                     cAns
           8.4
A113
                     fAmt.
A114
A115
A116
A117
                     nVal
A118
A119
A11A
            ?
A11B
```

ASCII value of 'A' is 65.

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
                       // 'D'
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
A112
          'D'
                  cAns
          8.4
A113
                  fAmt.
A114
A115
A116
A117
                  nVal
A118
A119
A11A
A11B
```

ASCII value of 'A' is 65.

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
                       // 'D'
    nVal = nVal - 3:
    return 0;
```

Memory

```
A111
A112
          'D'
                  cAns
          8.4
A113
                  fAmt.
A114
A115
A116
A117
                  nVal
A118
A119
A11A
A11B
```

ASCII value of 'A' is 65.

```
int main()
    int nVal;
    char cAns = 'G';
    float fAmt = 3.5;
    fAmt = 7;
    fAmt = fAmt * 1.2;
                       // 8.4
    cAns = cAns - 3;
                           // יחי
    nVal = nVal - 3:
    return 0;
```

```
A111
A112
          'D'
                  cAns
          8.4
A113
                  fAmt.
A114
A115
A116
A117
                   nVal.
A118
A119
A11A
A11B
```

- ASCII value of 'A' is 65.
- Variables not initialized have garbage values.

```
Memory
                                                A111
int main()
                                                A112
                                                          'D'
                                                                   cAns
     int nVal;
                                                          8.4
                                                A113
                                                                   fAmt.
     char cAns = 'G';
                                                A114
    float fAmt = 3.5;
                                                A115
    fAmt = 7;
                                                A116
    fAmt = fAmt * 1.2;
                            // 8.4
                                                A117
                                                                   nVal.
                                                A118
     cAns = cAns - 3;
                                // יחי
                                                A119
    nVal = 5;
    nVal = nVal - 3:
                                               A11A
                                                A11B
    return 0;

    ASCII value of 'A' is 65.

    Variables not initialized have garbage
```

values.

be initialized.

```
Memory
                                                A111
int main()
                                                A112
                                                           'D'
                                                                   cAns
     int nVal;
                                                           8.4
                                                A113
                                                                   fAmt.
     char cAns = 'G';
                                                A114
    float fAmt = 3.5;
                                                A115
    fAmt = 7;
                                                A116
    fAmt = fAmt * 1.2;
                             // 8.4
                                                A117
                                                            5
                                                                    nVal.
                                                A118
     cAns = cAns - 3;
                                 // יחי
                                                A119
    nVal = 5;
    nVal = nVal - 3:
                                                A11A
                                                A11B
    return 0;

    ASCII value of 'A' is 65.

    Variables not initialized have garbage

                                                values.
```

be initialized

```
Memory
                                                A111
int main()
                                                A112
                                                          'D'
                                                                   cAns
     int nVal;
                                                          8.4
                                                A113
                                                                   fAmt.
     char cAns = 'G';
                                                A114
    float fAmt = 3.5;
                                                A115
    fAmt = 7;
                                                A116
    fAmt = fAmt * 1.2;
                            // 8.4
                                                A117
                                                           5
                                                                   nVal.
                                                A118
     cAns = cAns - 3;
                                יתי //
                                                A119
    nVal = 5;
    nVal = nVal - 3:
                                                A11A
                                                A11B
    return 0;

    ASCII value of 'A' is 65.

    Variables not initialized have garbage
```

values.

be initialized

```
A111
int main()
                                             A112
                                                       'D'
                                                               cAns
    int nVal;
                                                       8.4
                                             A113
                                                               fAmt.
    char cAns = 'G';
                                             A114
    float fAmt = 3.5;
                                             A115
    fAmt = 7;
                                             A116
    fAmt = fAmt * 1.2;
                           // 8.4
                                             A117
                                                        5
                                                               nVal.
                                             A118
    cAns = cAns - 3;
                              // יחי
                                             A119
    nVal = 5;
    nVal = nVal - 3:
                              // 5 - 3
                                             A11A
                                             A11B
    return 0;

    ASCII value of 'A' is 65.
```

Variables not initialized have garbage

values.

be initialized

```
Memory
                                                A111
int main()
                                                A112
                                                          'D'
                                                                   cAns
     int nVal;
                                                          8.4
                                                A113
                                                                   fAmt.
     char cAns = 'G';
                                                A114
    float fAmt = 3.5;
                                                A115
    fAmt = 7;
                                                A116
    fAmt = fAmt * 1.2;
                            // 8.4
                                                A117
                                                           2
                                                                   nVal.
                                                A118
     cAns = cAns - 3;
                                                A119
    nVal = 5;
    nVal = nVal - 3:
                                                A11A
                                                A11B
    return 0;

    ASCII value of 'A' is 65.

    Variables not initialized have garbage
```

values.

be initialized

```
A111
int main()
                                          A112
                                                   'D'
                                                           cAns
    int nVal;
                                                   8.4
                                          A113
                                                           fAmt.
    char cAns = 'G';
                                          A114
    float fAmt = 3.5;
                                          A115
    fAmt = 7;
                                          A116
    fAmt = fAmt * 1.2;
                         // 8.4
                                          A117
                                                    2
                                                           nVal.
                                          A118
    cAns = cAns - 3;
                                          A119
    nVal = 5;
    nVal = nVal - 3:
                                          A11A
                                          A11B
    return 0;
```

ASCII value of 'A' is 65.

- Variables not initialized have garbage values.
- Variables that will be read first, MUST be initialized

```
A111
int main()
                                             A112
                                                       'D'
    int nVal;
                                                       8.4
                                             A113
    char cAns = 'G';
                                             A114
    float fAmt = 3.5;
                                             A115
    fAmt = 7;
                                             A116
    fAmt = fAmt * 1.2;
                          // 8.4
                                             A117
                                                        2
                                             A118
    cAns = cAns - 3;
                                             A119
    nVal = 5;
    nVal = nVal - 3:
                                             A11A
                                             A11B
    return 0;

    ASCII value of 'A' is 65.

                                             values.
```

cAns fAmt. nVal.

- Variables not initialized have garbage
- Variables that will be read first, MUST be initialized

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
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```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

Tracing on paper:

x = 5

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

Tracing on paper:

x = 5

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

```
x = 5
y =
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

```
x = 5y = 5
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

```
x = 5
y = 5
z = ?
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

```
x = 5

y = 5

z = ?
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

Tracing on paper:

$$x = 5$$
 $y = 5$
 $z = ?$

Note that = has right to left associativity.

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

Tracing on paper:

```
x = 5

y = 5

z = ?
```

Note that = has right to left associativity.

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

Tracing on paper:

```
x = 5
y = 5
z = ? 5
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
}
```

Tracing on paper:

```
x = 5
y = 5
z = ? 5
m =
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

    return 0;
```

Tracing on paper:

```
x = 5

y = 5

z = ? 5

m = 5
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;

return 0;
```

Tracing on paper:

```
x = 5

y = 5

z = ? 5

m = 5
```

```
int main()
{
    int x = 5;
    int y = x, z;
    int m = z = y;
    return 0;
}
```

Tracing on paper:

```
x = 5
y = 5
z = ? 5
m = 5
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y;
    return 0;
}
```

Remember!

Variables MUST have been declared before first use.

```
int main()
{
    int x = 5;
    int y = x;
    int m = z = y; // compile-time error
    return 0;
}
```

Remember!

Variables MUST have been declared before first use.

