

APS 105

Winter 2012

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Lecture 17
February 29, 2012

Today

- Arrays and Pointers
- Midterm Info
- Midterm Tips
- Midterm Review

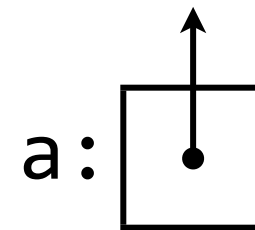
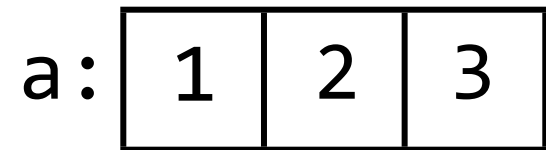
Array Names

- The name of an array can be used as a pointer to its first element

```
int a[] = {1, 2, 3};
```

```
a[0] = 5;
```

```
*a = 5;
```



Array Arguments

```
int sumArray(int a[], int n)
{
    int sum = 0;
    for (int i = 0; i < n; i++)
    {
        sum += a[i];
    }
    return sum;
}
```

```
int a[] = {1, 2, 3};
int sum = sumArray(a, n);
```

Array Arguments

- Arrays are passed as pointers

```
int sumArray(int a[], int n)
{
    ...
}
```

```
int sumArray(int *a, int n)
{
    ...
}
```

Consequences

- Array elements can be changed by functions
- No penalty for passing large arrays

```
void sort(int a[], int n)
{
    ...
}
```

```
void printList(const int list[], int n)
{
    ...
}
```

Why Treat Arrays as Pointers?

- Sometimes yields clearer code
 - Sometimes easier (e.g., large arrays)
 - Some historical benefits
-
- Use what makes sense for a particular problem

[Midterm Covers Everything up to Here]

Midterm

Midterm Info

- This Friday (March 2)
- During Tutorial: 3:15 pm - 5:00 pm
- Rooms will be posted on website

Test and Exam Tips

- Read the whole thing first
- Read every question carefully
- Make things easy for the marker

What We're Asking

- More than just “what does the function do?”
- Do we want a complete program? A code snippet? An example of using a function?

Question 0

Write your student number in the space provided at the bottom of each odd-numbered page, and write your name in the space provided on the back page.

Failure to do so will result in a 2 mark deduction.

Buggy Code Question

```
1  voi printHello(void)
   {
       printf('Hello');
   }
```

2

- 1) “void” is misspelled “voi”
- 2) Format string is in single quotes, should be in double quotes

Approaching Coding Questions

- Read it carefully
 - *What am I being asked to do?*
- Figure out the pseudocode
 - *How do I go about doing it?*
- Write the code
 - *How do I translate the pseudocode into C code?*
- Re-read the question
 - *Does my code do what it was supposed to?*

How to Handwrite Code

- We realize that there is no compiler on paper

```
printf("%d" value);  
printf("%d". value);
```

- However, consistent or egregious syntax errors are a problem

```
while { if [! 45.3] > 3} {true};
```

How to Handwrite Code

- Some symbols are hard to draw ({ } and &)
- Indenting
- Tell us what you're doing
- Leave lots of space

```
for (int i = 0; i < 10; i++)  
{  
    printf("%d\n");  
}
```

```
for (int i = 0; i < 10; i++)  
{  
    printf("%d\n");  
}
```

```

for (int i = 0; i < 10; i++)
{
    printf("%d\n");
}

```

```

for (int i = 0; i < 10; i++)
{
    printf("%d\n");
}

```

```

for (int i = 01; i <= 10; i++)
{
    if (i != 5)
    {
        printf("%d\n");
    }
}

```

```

for (int i = 01; i < 10; i++)
{
    if (i != 5)
    {
        printf("%d\n");
    }
}

```

Sample Questions

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

```
int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}
```

i:

```
int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}
```

i:

j:

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

j:

n:

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

j:

n:

a:

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: 1

j:

n: 6

a: ' '

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

j:

n:

a:

*

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: 1

j: 2

n: 6

a: ' '

*

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: 1

j: 2

n: 6

a: '␣'

*←

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ 2

j: 2

n: 6

a: ' '

* ←

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~2

j: 2

n: 6

a: ' '

* ←
*

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ 2

j: ~~2~~ 2

n: 6

a: ' '

* ←
*

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ 2

j: ~~2~~ 2

n: 6

a: ' '

* ←

* *

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ 2

j: ~~2~~ 2

n: 6

a: ' '

* ←

* * ←

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ 2

n: 6

a: ' '

* ←

* * ←

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ 2

n: 6

a: ' '

```

* ←
* * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ ~~2~~ 2

n: 6

a: ' '

```

* ←
* * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ ~~2~~ 2

n: 6

a: ' '

```

* ←
* * ←
* 

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ ~~2~~ ~~2~~ 3

n: 6

a: ' '

```

* ←
* * ←
* 

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ ~~2~~ ~~2~~ 3

n: 6

a: ' '

```

* ←
* * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i: ~~1~~ ~~2~~ 3

j: ~~2~~ ~~2~~ ~~2~~ 3

n: 6

a: ' '

```

* ←
* * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3
--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3
--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2
--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2
--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2	3
--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2	3
--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  _

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4
--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  _

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4
--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4
--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4
--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4
--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4
--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

*←┐
* *←┐
*  *←┐
*  *←┐
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2
--------------	--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2
--------------	--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

j:

n:

a:

```

* ←
* * ←
*  * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	---

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
				4				

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
				4				

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  *  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5
--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5							

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2						

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2						

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*  *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3					

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3					

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4				

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4				

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5			

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5			

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * * * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5	6		

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * * * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5	6		

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
* * * * *

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6
--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5	6		

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*  * ←
* * * * * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6	7
--------------	--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5	6		

n:

6

a:

' '	'*'
----------------	-----

```

* ←
* * ←
*  * ←
*  * ←
*  * ←
*  * ←
* * * * * ←

```

```

int main(void)
{
    int i, j, n = 6;
    char a = ' ';
    for (i = 1; i <= n; i++)
    {
        printf("*");
        if (i == n)
        {
            a = '*';
        }
        for (j = 2; j < i; j++)
        {
            printf("%c", a);
        }
        if (i != 1)
        {
            printf("*");
        }
        printf("\n");
    }
    return 0;
}

```

i:

1	2	3	4	5	6	7
--------------	--------------	--------------	--------------	--------------	--------------	---

j:

2	2	2	3	2	3	4	2	3
4	5	2	3	4	5	6		

n:

6

a:

' '	'*'
----------------	-----

```

*
* *
*  *
*   *
*    *
*     *
* * * * *

```

Write a complete C program that first requests and reads two positive integers. The program should then continue to read integers, one at a time, as long as the sum total of all input integers is less than 17 and no greater than 21. Once the program has finished reading, it should print either the total, if it is 21 or less, or the words "I lose" if the total is over 21. You may assume that the range of integers entered by the user is between 1 and 11 (inclusive).

```
First number? 5 [enter]
Second number? 1 [enter]
Next number? 4 [enter]
Next number? 4 [enter]
Next number? 5 [enter]
Final total: 19
```

```
First number? 11 [enter]
Second number? 11 [enter]
I lose
```

Write a complete C program that first requests and reads two positive integers. The program should then continue to read integers, one at a time, as long as the sum total of all input integers is less than 17 and no greater than 21. Once the program has finished reading, it should print either the total, if it is 21 or less, or the words "I lose" if the total is over 21. You may assume that the range of integers entered by the user is between 1 and 11 (inclusive).

Request and read two positive ints

Add them to the total

while (the total is < 17 and <= 21)

 Request and read another number

 Add it to the total

if (the total is <= 21)

 Print the total

else

 Print "I lose"

```
int total = 0;
int number;
printf("First number? ");
scanf("%d", &number);
total += number;
printf("Second number? ");
scanf("%d", &number);
total += number;
```

Request and read two positive ints

Add them to the total

while (the total is < 17 and <= 21)

 Request and read another number

 Add it to the total

if (the total is <= 21)

 Print the total

else

 Print "I lose"

```
int total = 0;
int number;
printf("First number? ");
scanf("%d", &number);
total += number;
printf("Second number? ");
scanf("%d", &number);
total += number;
while (total < 17)
{
    printf("Next number? ");
    scanf("%d", &number);
    total += number;
}
```

Request and read two positive ints

Add them to the total

while (the total is < 17 and <= 21)

 Request and read another number

 Add it to the total

if (the total is <= 21)

 Print the total

else

 Print "I lose"

```

int total = 0;
int number;
printf("First number? ");
scanf("%d", &number);
total += number;
printf("Second number? ");
scanf("%d", &number);
total += number;
while (total < 17)
{
    printf("Next number? ");
    scanf("%d", &number);
    total += number;
}
if (total <= 21)
{
    printf("Final total: %d\n", total);
}

```

Request and read two positive ints

Add them to the total

while (the total is < 17 and <= 21)

 Request and read another number

 Add it to the total

if (the total is <= 21)

 Print the total

else

 Print "I lose"

```

int total = 0;
int number;
printf("First number? ");
scanf("%d", &number);
total += number;
printf("Second number? ");
scanf("%d", &number);
total += number;
while (total < 17)
{
    printf("Next number? ");
    scanf("%d", &number);
    total += number;
}
if (total <= 21)
{
    printf("Final total: %d\n", total);
}
else
{
    printf("I lose\n");
}

```

Request and read two positive ints

Add them to the total

while (the total is < 17 and <= 21)

 Request and read another number

 Add it to the total

if (the total is <= 21)

 Print the total

else

 Print "I lose"

What We've Covered

- What's a computer?
- What does it mean to program it?
- How to we take an English problem and translate it to a program?
- How do we write a program?
- What are the parts of a program?
 - Variables, expressions, statements

What We've Covered

- Types
 - `int`, `double`, `char`
 - Arithmetic operators
- Style
- Reading/writing data
 - `printf()`, `scanf()`, conversion specifiers
- Booleans (`bool` and Boolean operators)
- Relational and comparison operators

What We've Covered

- `if, else if, and else`
- `while` and `for` loops
- Arrays
- Functions (parameters, return values, scope)
 - `math.h`, Random Numbers
 - Helper Functions
- Indirection and Pointers
 - Pointer Arithmetic