Funcy Arrays

ESC101: Fundamentals of Computing

Purushottam Kar

Recap – 6 golden rules of functions

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RULE 6: All clones share the memory address space

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Notice that when we pass an array to scanf (strings), scanf is able to change the values inside that array

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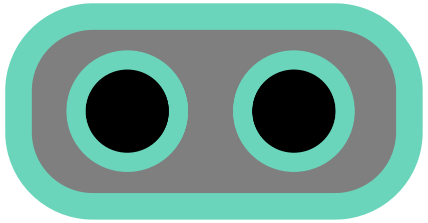

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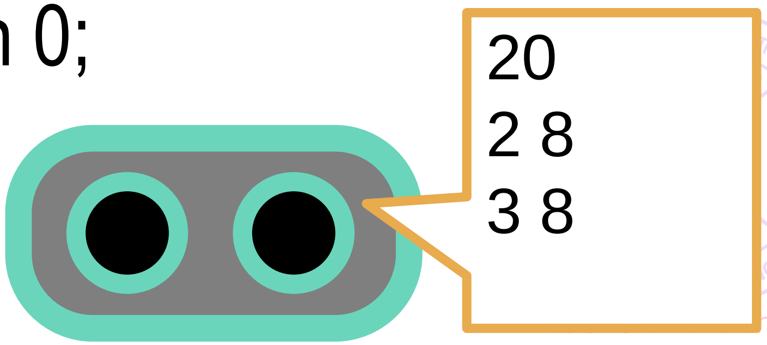

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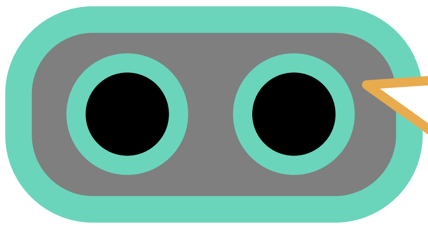

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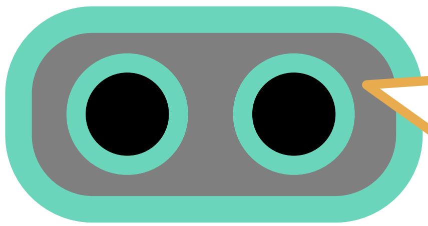

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Recall that b[1] is the same as *(b+1)

&a[0] gets passed

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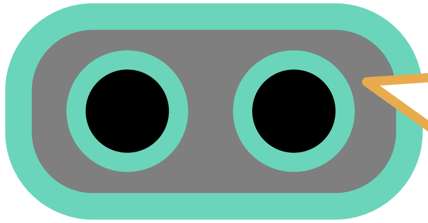

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void print2ndElement(int b[], int arrLength)
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- <u>Advantage</u>: can exploit this to return arrays from a function
- <u>Disadvantage</u>: can cause memory leaks if you are not careful – remember to free arrays before a function exits if the array no longer needed

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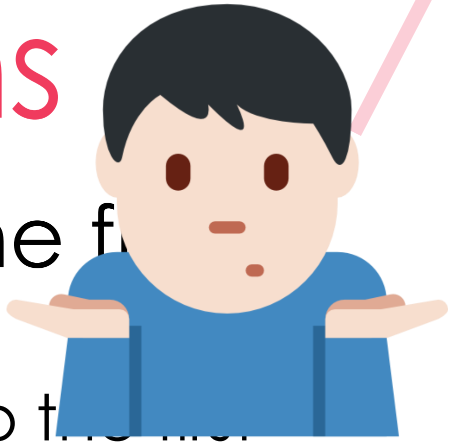

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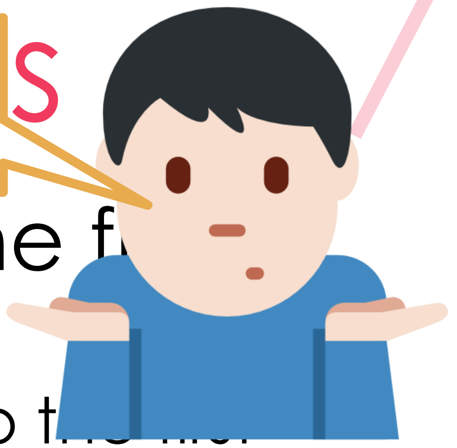

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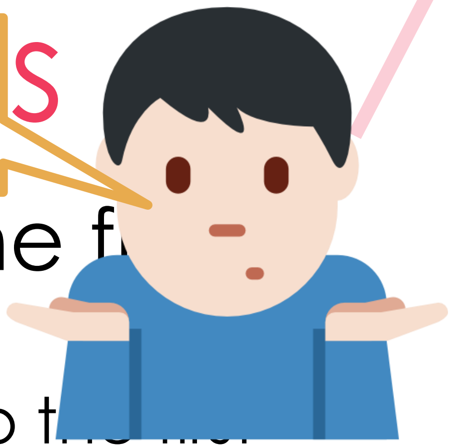

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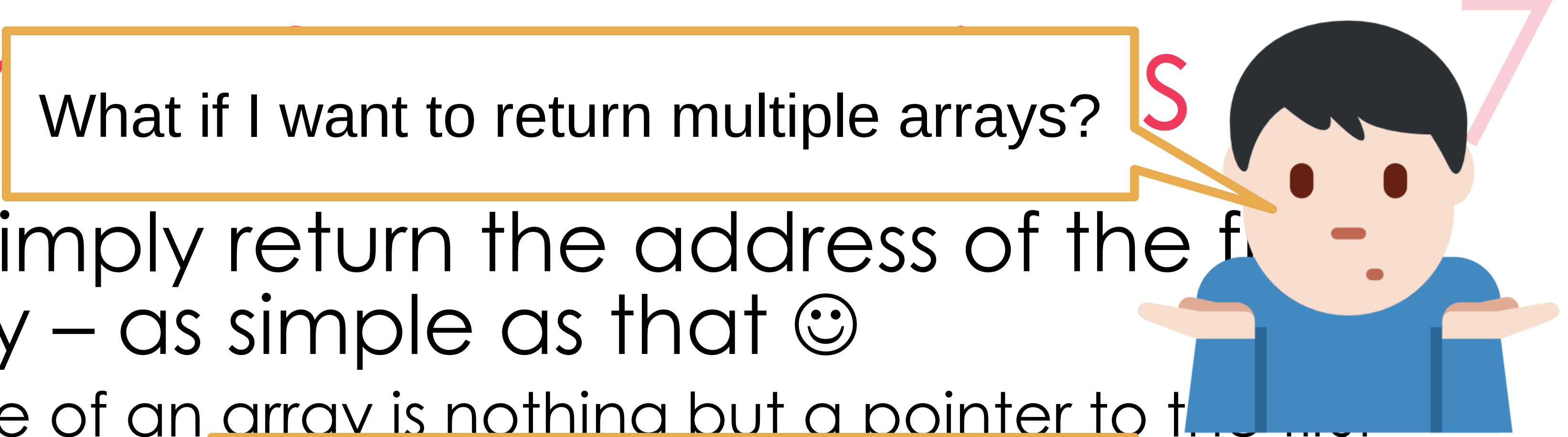

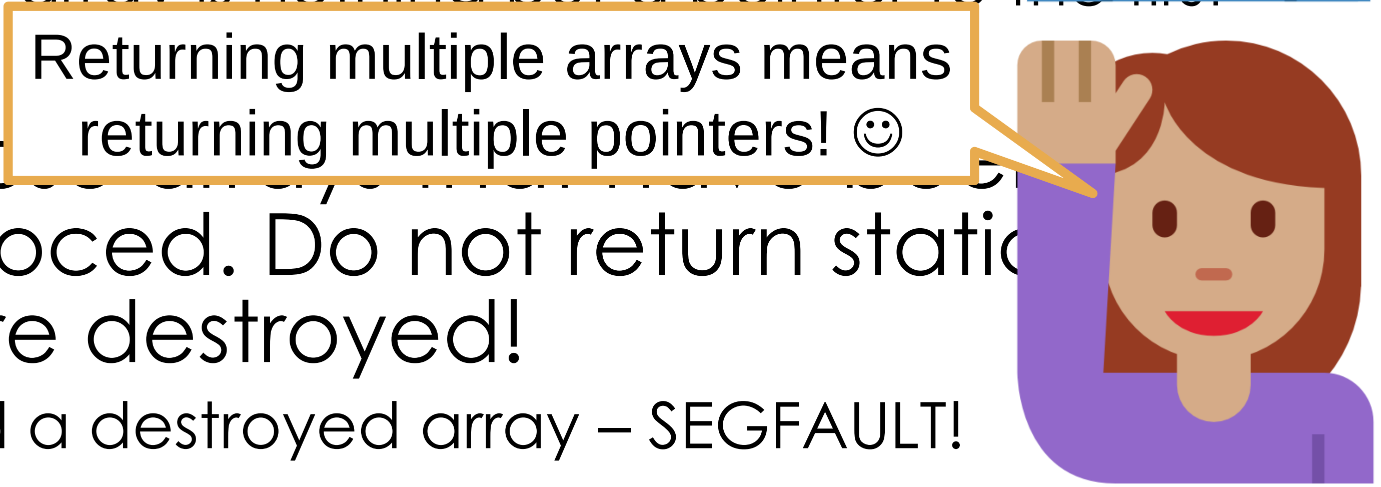
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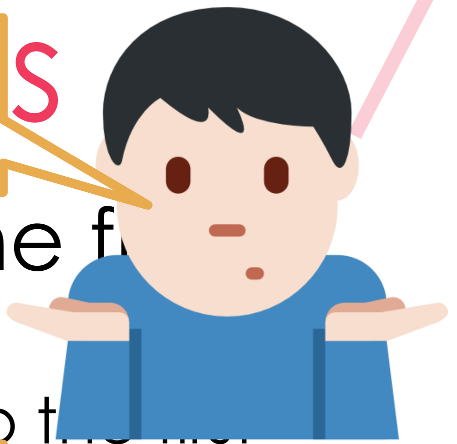

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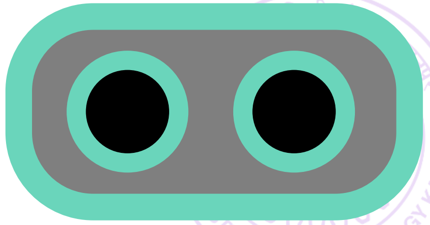

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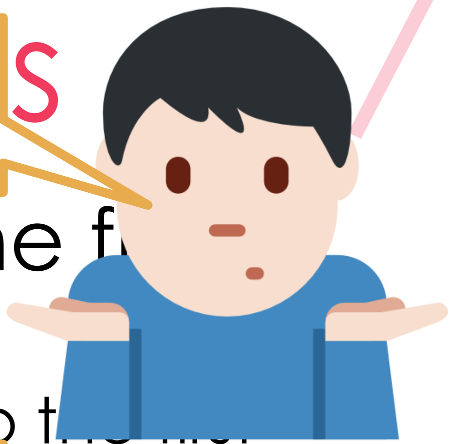

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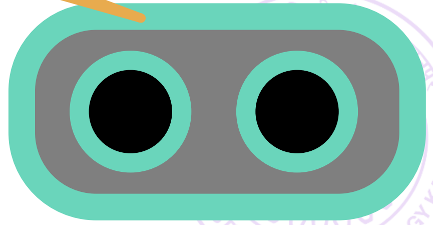

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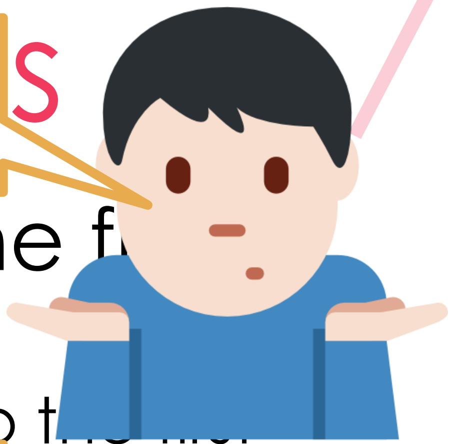
element of that array

WARNING: return only tho
malloced/calloced/realloced. Do not return static
declared arrays – they are destroyed!

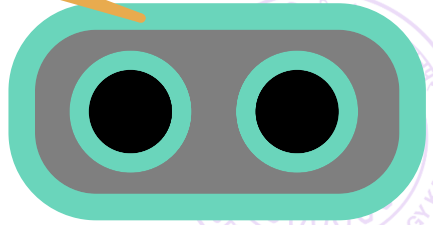
- If the main function tries to read a destroyed array – T!

Gives us another trick of returning multipl es from a function – simply return an array

- Advantage: can return as many values as you want ☺
- Disadvantage: all those values have to be of that same type
- Disadvantage: can only return one array ☹

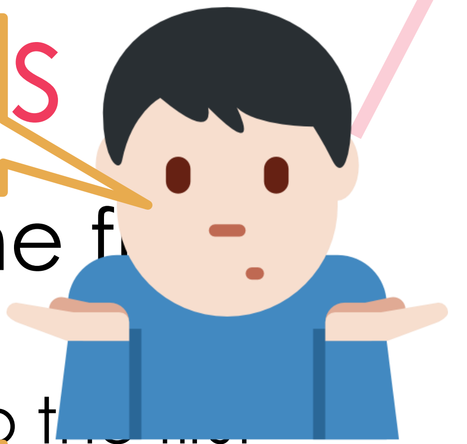


Returning multiple arrays means returning multiple pointers! ☺



Returning Arr s

What if I want to return multiple arrays?



To return an array, simply return the address of the f
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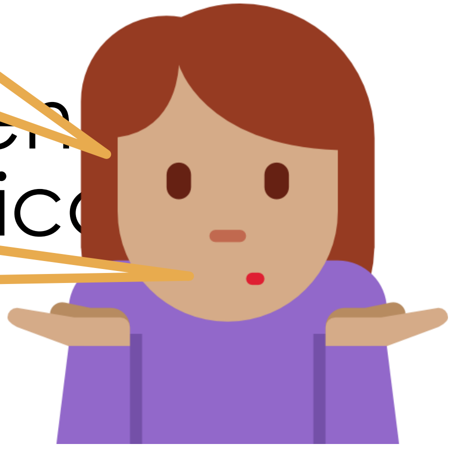

How do I return multiple pointers?

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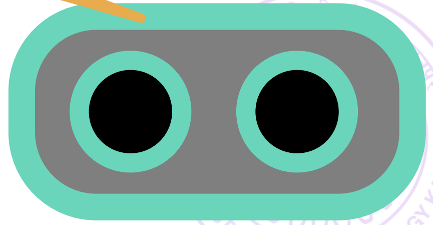
If the main function tries to read a destroyed array – T!

Correct!



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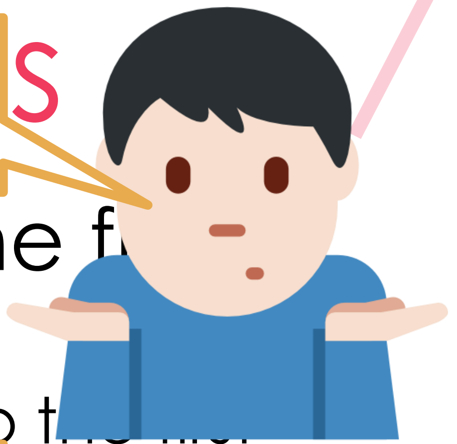
How do I return multiple pointers?

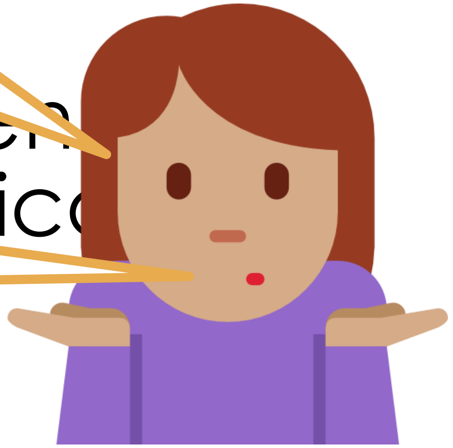
If the main function tries to read a destroyed array – T!

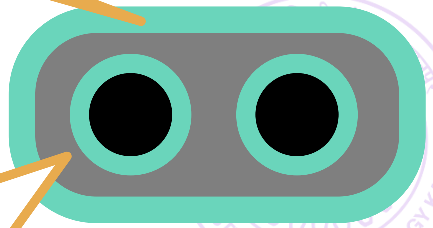
Correct!

Gives us another trick of returning multi es from a
fu

Using the same tricks we learnt till now to return multiple variables
Trick 1: malloc an array of pointers and return that array
Trick 2: ask the calling function to tell you the address where a pointer variable is stored so that you can modify the address (this will require passing a pointer to a pointer to the function)







Passing 2D arrays as inputs

Passing 2D arrays as inputs

More care required for 2D arrays

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Recall 2D arrays are stored as 1D arrays

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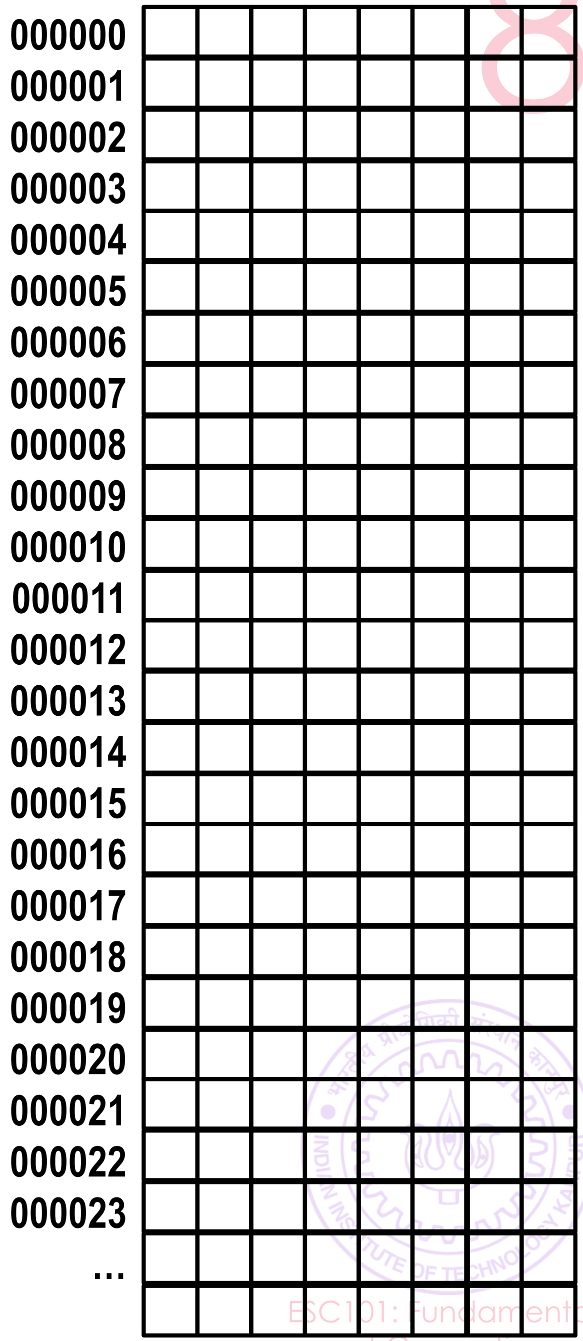

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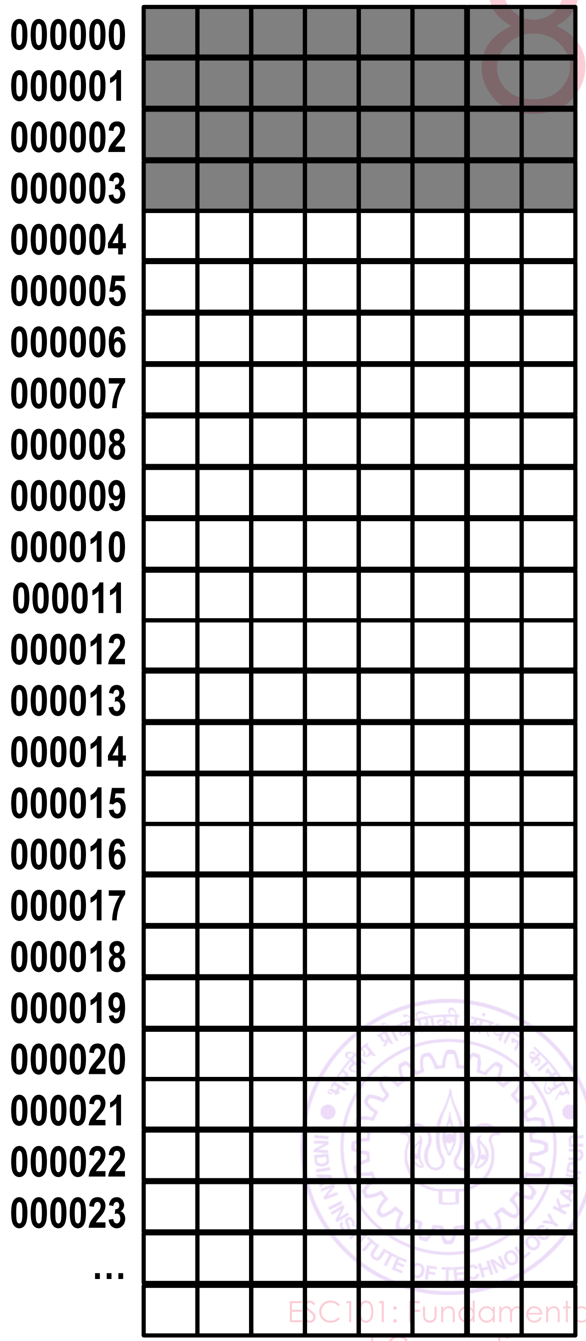

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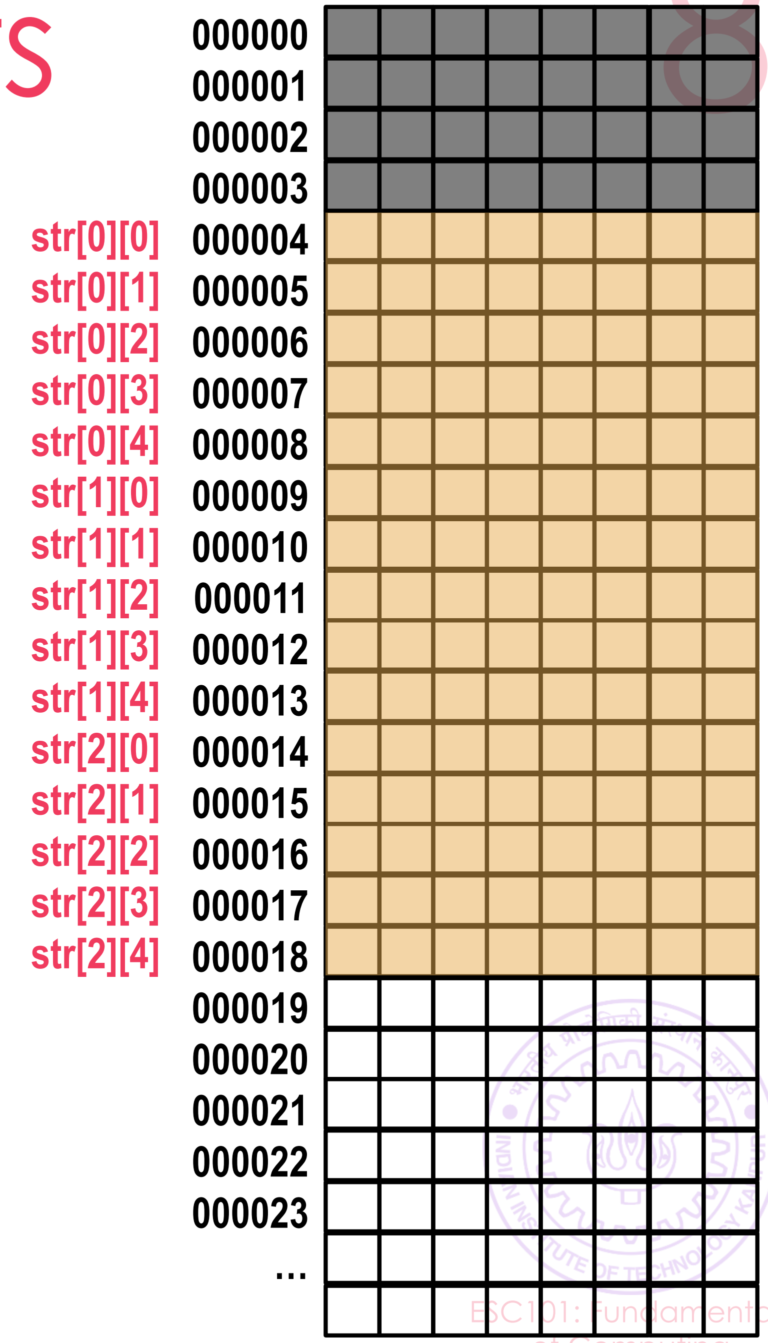

Passing 2D arrays as inputs

More care required for 2D arrays

Recall 2D arrays are stored as 1D arrays

```
char str[3][5];
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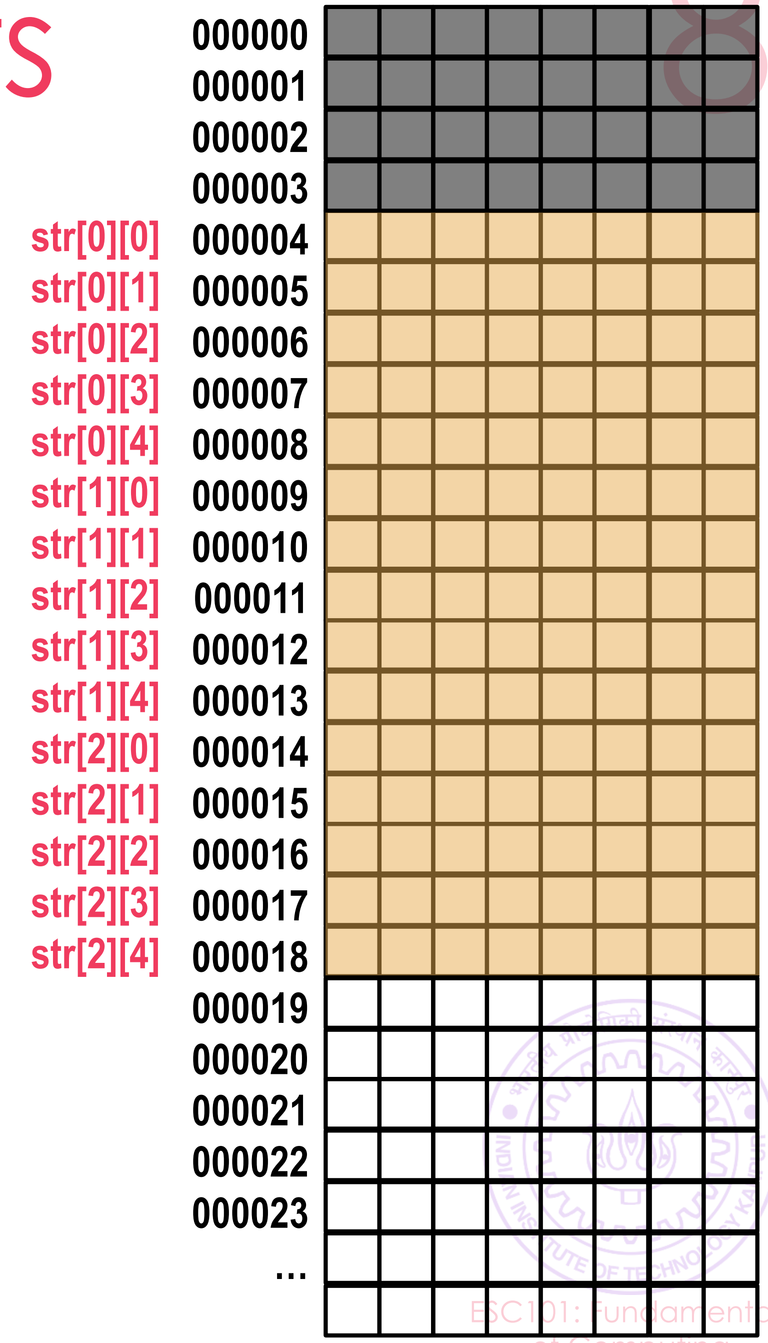
This means, in order to access str[1][0], we need to skip 5 elements



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More care required for 2D arrays

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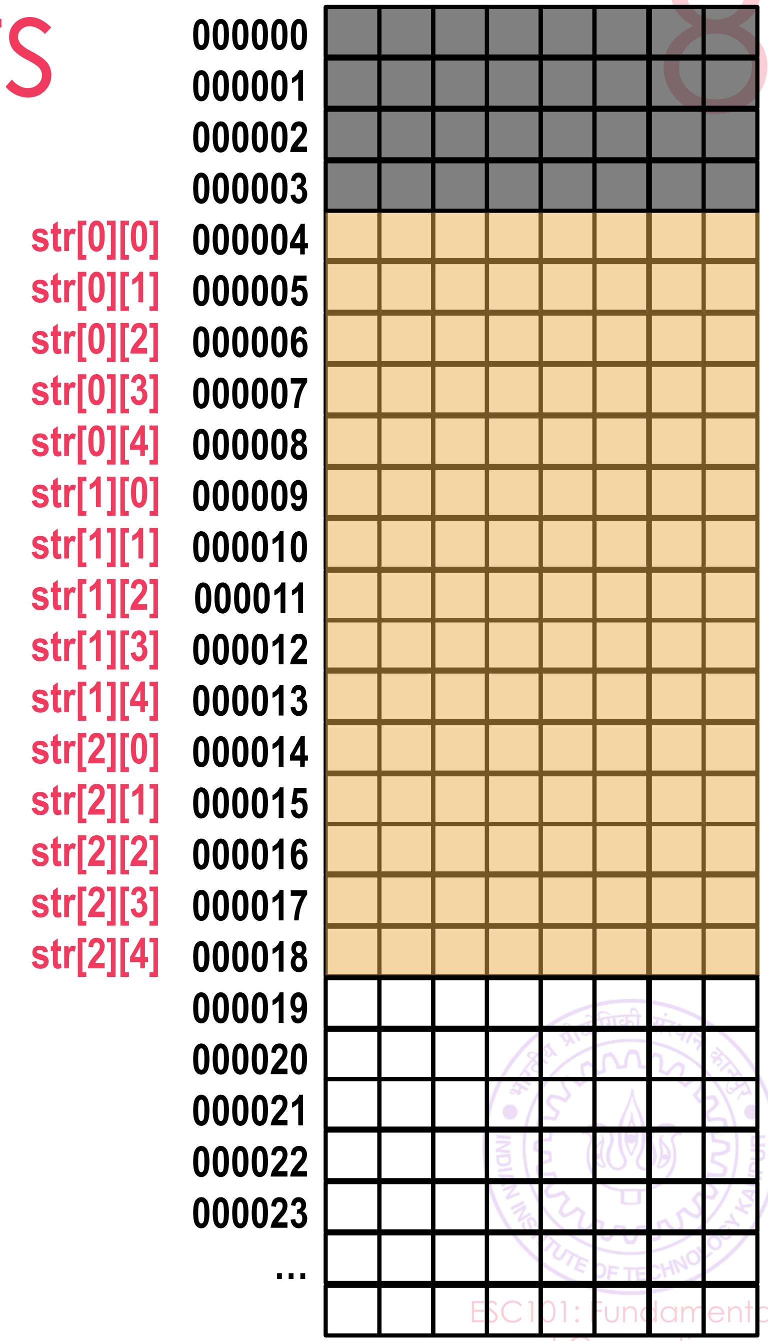
To do so we need to know how many elements are there in each row



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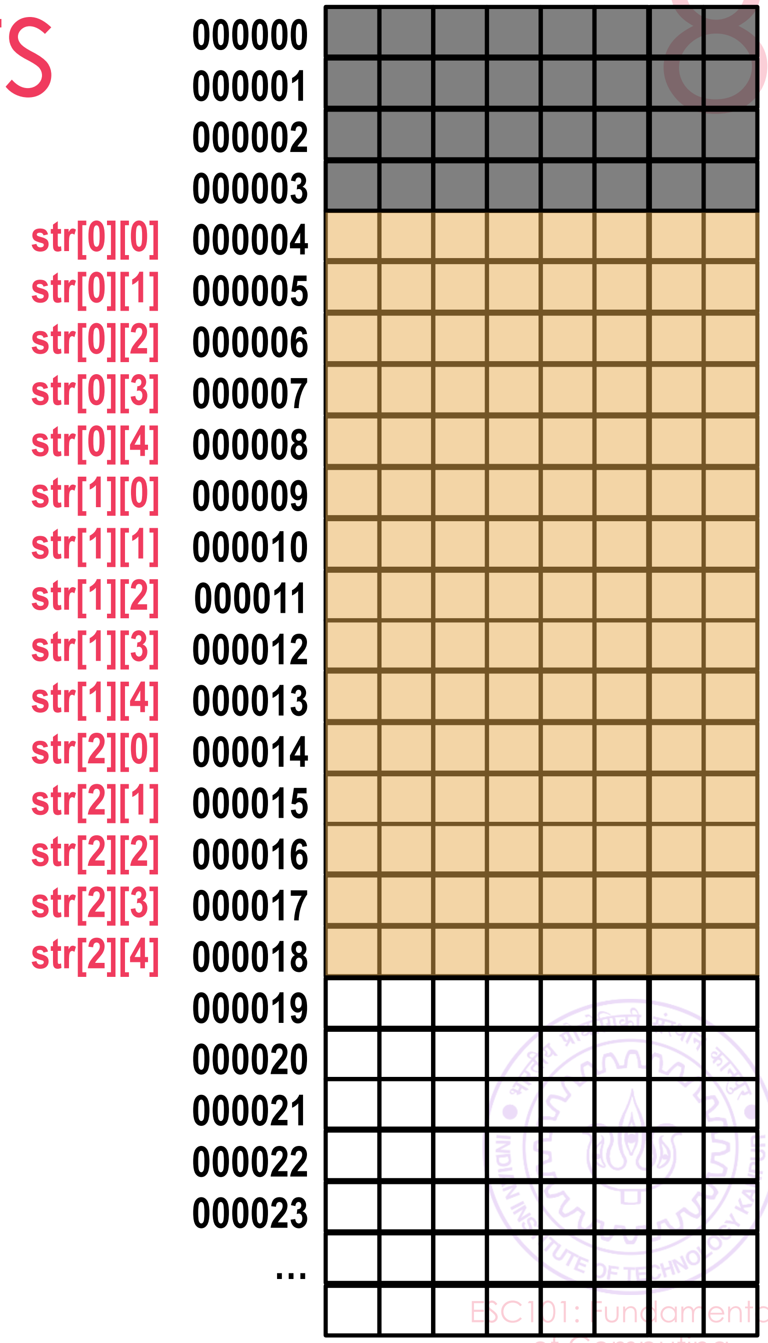
If passing a 2D array to a clone, must tell that clone this information



Passing 2D arrays to functions

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Case 1: both the number of rows and the number of columns are fixed

Passing 2D arrays to functions

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```
void access2D(char str[3][5], int i, int j){
    printf("%c", str[i][j]);
}
int main(){
    char str[3][5] = {"Hi","Wow","Bye"};
    access2D(str, 1, 0);
    return 0;
}
```

Passing 2D arrays to functions

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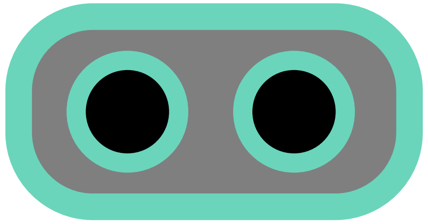

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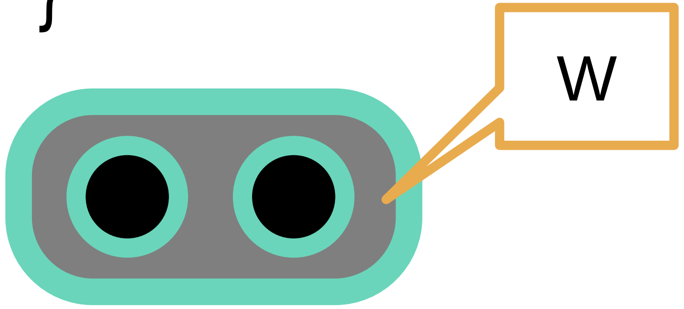

Passing 2D arrays to functions

Case 1: both the number of rows and the number of columns are fixed

Notice that our usual way of accessing array elements works here just fine!

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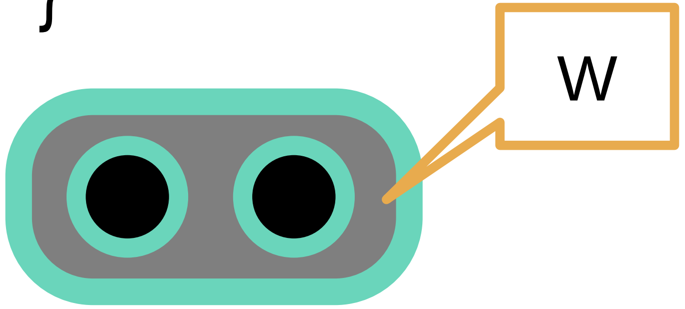

Passing 2D arrays to functions

Passing 2D arrays to functions

Case 2: number of rows unknown but number of columns are fixed

Passing 2D arrays to functions

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```
void access2D(char str[][5], int i, int j){
    printf("%c", str[i][j]);
}
int main(){
    char str[3][5] = {"Hi","Wow","Bye"};
    access2D(str, 2, 1);
    return 0;
}
```

Passing 2D arrays to functions

Case 2: number of rows unknown but number of columns are fixed

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void access2D(char str[][5], int i, int j){
    printf("%c", str[i][j]);
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Passing 2D arrays to functions

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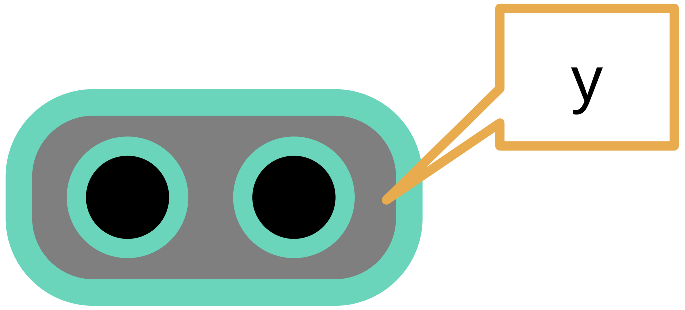

Passing 2D arrays to functions

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Notice that our usual way of accessing array elements still works here just fine!

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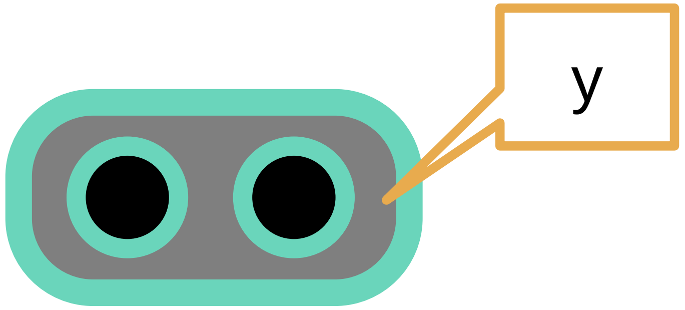

Passing 2D arrays to functions

Case 2: number of rows unknown but number of columns are fixed

Notice that our usual way of accessing array elements still works here just fine!

Note that specifying number of rows is not needed at all!

```
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int main(){
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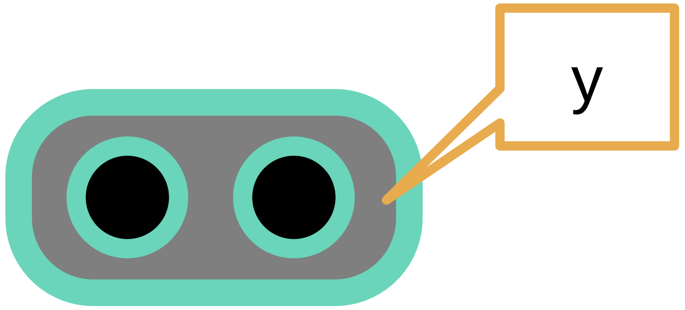

Passing 2D arrays to functions

Passing 2D arrays to functions

Case 3: both num. of rows and number of columns are unknown ☹

Passing 2D arrays to functions

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Here, Mr C doesn't know how to access 2nd row elements

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Trick 1: treat 2D array as a 1D array and do the indexing yourself ☺

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```
void access2D(char* str, int i, int j, int c){
    // c gives num of columns i.e. num of
    // elements in each row
    printf("%c", *(str + c * i + j));
}
int main(){
    char str[3][5] = {"Hi","Wow","Bye"};
    char *ptr = &str[0][0];
    int numCols = 5;
    access2D(str, 1, 2, numCols);
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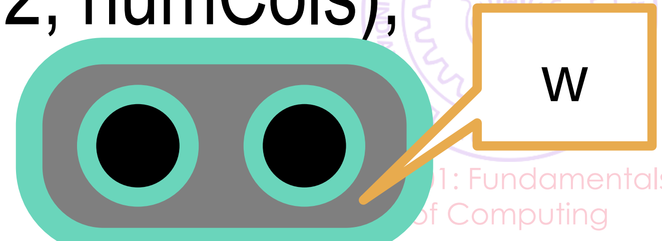

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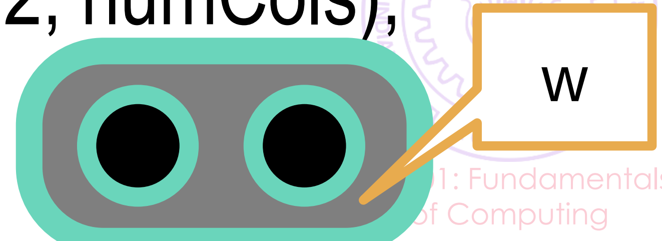

Passing

If accessing row index 0 column index 2, simply skip 2 elements of first row. If accessing row index 1 column index 2, first skip 5 elements of first row and then skip 2 elements of 2nd row

Cas

and nber of columns are unkn own ☹

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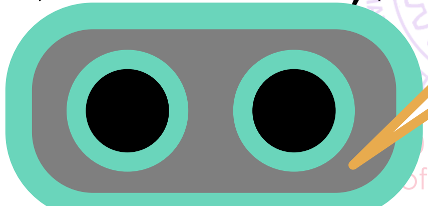

Passing 2D arrays to functions

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Trick 2: create array of arrays

Passing 2D arrays to functions

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- This works since going to the second row does not require knowing how many elements are there in first row

Passing 2D arrays to functions

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- In case of arrays of arrays, every row has a separate pointer pointing to its first element – see last week's lecture

Passing 2D arrays to functions

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```
void access2D(char** str, int i, int j){
    printf("%c", str[i][j]);
}
int main(){
    char **str = (char**)malloc(3*sizeof(char*));
    int i;
    for(i = 0; i < 3; i++){
        str[i] = (char*)malloc(5*sizeof(char));
        gets(str[i]);
    }
    access2D(str, 1, 1);
    return 0;
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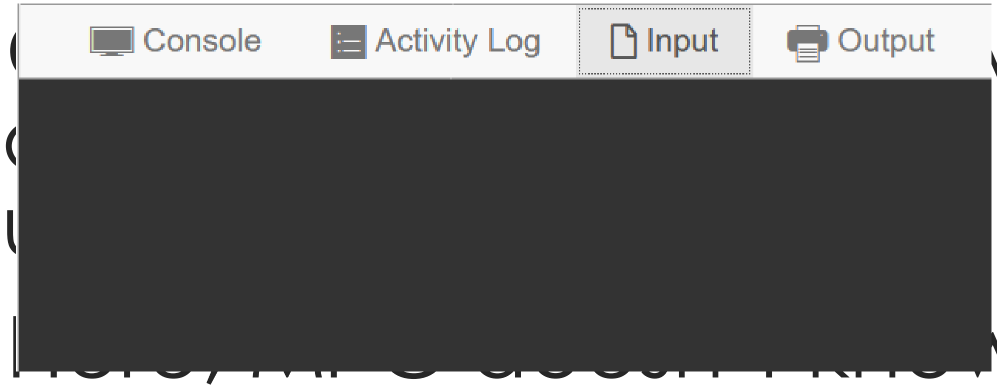
```

Passing 2D arrays to functions



ws

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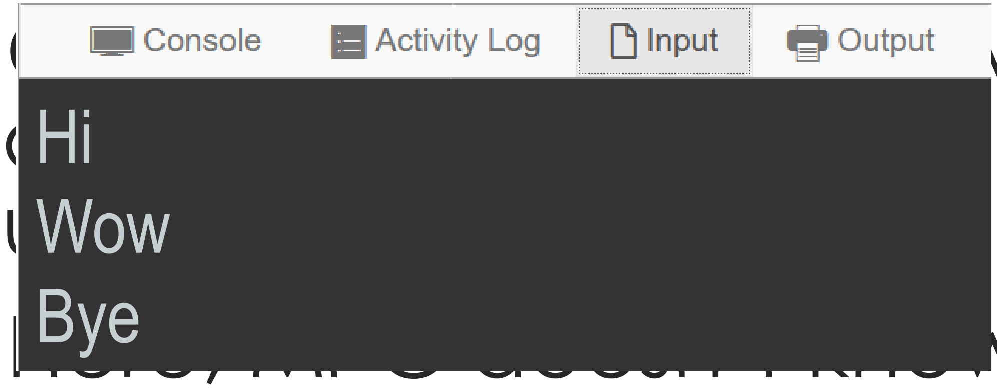
Passing 2D arrays to functions



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Hi
Wow
Bye
```

ws are

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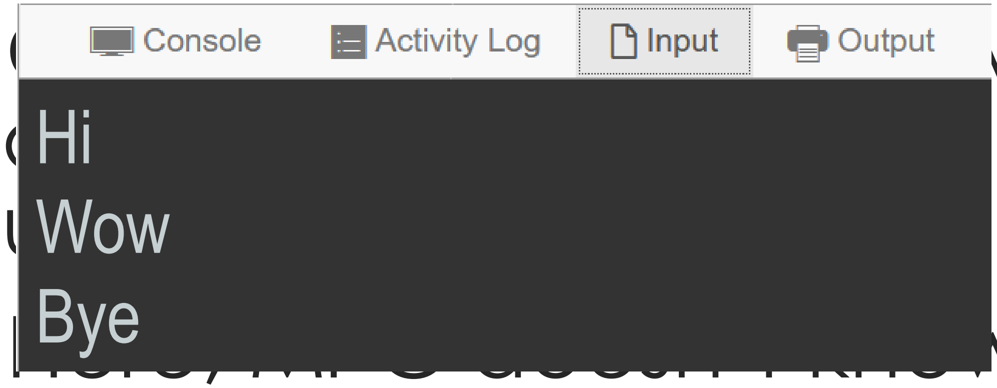
Passing 2D arrays to functions



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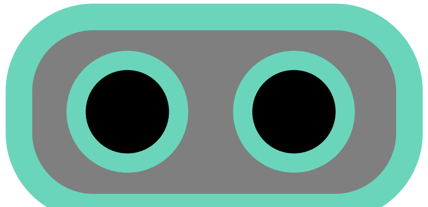
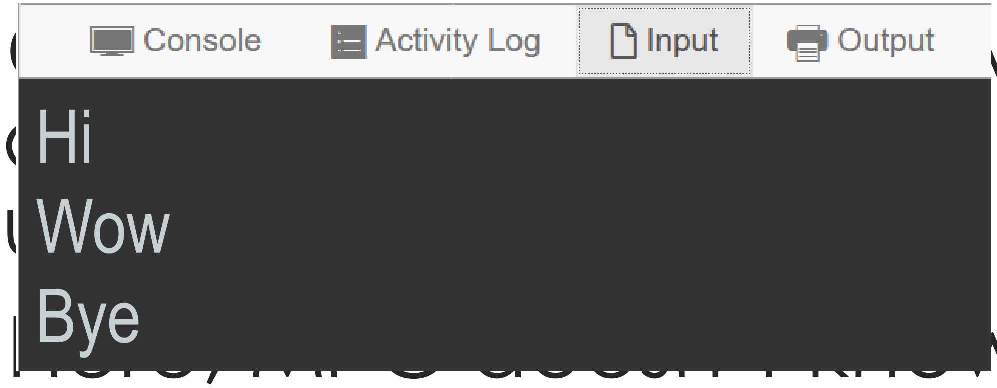


Passing 2D arrays to functions



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}
int main(){
    char **str = (char**)malloc(3*sizeof(char*));
    int i;
    for(i = 0; i < 3; i++){
        str[i] = (char*)malloc(5*sizeof(char));
        gets(str[i]);
    }
    access2D(str, 1, 1);
    return 0;
}
```