CSC209H Worksheet: Array and Pointer Basics

1. Here is the code of a small program that uses both arrays and pointers. Beside it we have drawn a memory diagram with the stack frame of `main`.

   Use this diagram to trace the execution of the program. When the value stored at a location changes, cross out the old one and write the new one (rather than simply writing the new one). If there are unitialized blocks of memory when `main` returns, write their values as **???**.

Notes:
- a variable is a label for a location in memory

```
int main() {
    int i = 2;
    int j = 30;

    int a[4];

    int *p;
    int *q;

    p = &i;
    j = *p;
    *p = 1;

    a[0] = 10;
    a[3] = 12;
    a[i] = 11;
    return 0;
}
```

Section	Address	Value	Label
stack frame for main	0x234	?	q
	0x238	.	
	0x23c	0x258	p
	0x240		
	0x244	10	a
	0x248	11	
	0x24c	?	
	0x250	12	
	0x254	30 2	j
	0x258	2 1	i
	0x25c		
	0x260		
	0x264		

Array names have an extra behaviour in C.
When we declare int a[4], the label for the location in memory where the array values are stored is a. From the declaration, the compiler knows to allocate 4 * sizeof(int) bytes.

The name of the array can be used as a pointer to the 0th element of the array in expression context.
In other words, a = &a[0], but we can't change the value of a

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2. Each example below contains an independent code fragment. In each case there are variables `x` and `y` that are missing declaration statements. In the boxes to the right of the code write declaration statements so that the code fragment would compile and run without warnings or errors.

	Code Fragment	Declaration for `x`	Declaration for `y`
A	`x = 10;` `y = 'A';`	int x	char y;

B	`int age = 99;`
	`x = &age;`
	`y = *x;`
		int *x	int y;

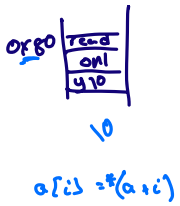
C	`double *p;`
	`x = &p;`
	`y = &x;`
		double** x	double *** y

D	`float f = 4.5;`
	`float *p = &f;`
	`x = &p;`
	`y = **x;`
		float ** x	float y

E	`char *result[2];`
	`x = result[0];`
	`// some hidden code`
	`result[0] = "read only";`
	`y = x[0];`
		char * x	char y

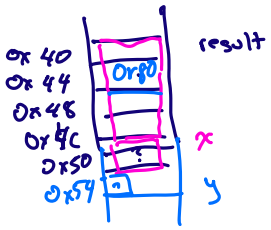
p = q

float q[5]



10

a[i] = *(a+i)



*x == x[0]

Announcements

- Office Hours Today - 3:30-4:30 BA 4290
- Lab 2 - please use tutorial time for questions about labs
  - Please help each other with Windows/WSL questions

What is the most surprising/weirdest thing you have learned about C so far?

```
int a[3]

a[5] = 10; → segmentation fault
```