

```
int _main(int argc, char** strs) {
    char str[] = "abcde";

    printf("%s\n", str);
    printf("%c %d\n", str[0], str[0]);
    printf("%c %d\n", str[5], str[5]);
    printf("%d\n", sizeof(str));
}
```

stack-allocated array

strs

main			
a 97	b 98	c 99	d 100
e 101	\0 0		

1. strings are char arrays

2. strings are terminated with \0

```
int main(int argc, char** strs) {
    char* str = calloc(56, sizeof(char));
    str[0] = 'a'; str[1] = 'b';
    str[2] = 'c'; str[3] = 'd';
    str[4] = 'e'; str[5] = '\0';

    printf("%s\n", str);
    printf("%c %d\n", str[0], str[0]);
    printf("%c %d\n", str[5], str[5]);
    printf("%d\n", sizeof(str));
}
```

strs

main	
@P	

@P

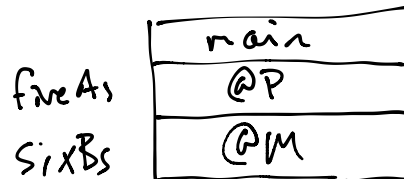
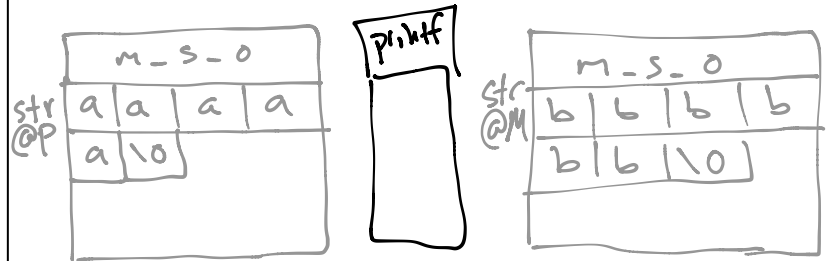
a	b	c	d
e	\0		

heap-allocated array

```
char* make_string_of(char c, int count) {
    char str[count + 1];
    int index = 0;
    for(index = 0; index < count; index += 1) {
        str[index] = c;
    }
    str[count] = '\0';
    return str;
}
```

DO NOT
return stack
arrays

```
int main(int argc, char** strs) {
    char* fiveAs = make_string_of('a', 5);
    printf("Five As: %s\n", fiveAs);
    char* sixBs = make_string_of('b', 6);
    printf("Six Bs: %s\n", sixBs);
}
```

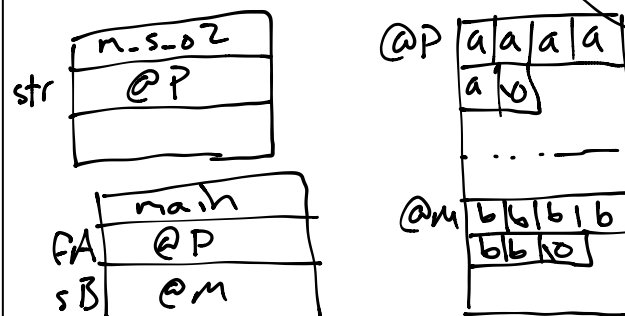
UNDEFINED
BEHAVIOR- read/write
out of bounds
- use "old" stack
data

```
char* make_string_of2(char c, int count) {
    char* str = calloc(count + 1, sizeof(char));
    int index = 0;
    for(index = 0; index < count; index += 1) {
        str[index] = c;
    }
    str[count] = '\0';
    return str;
}
```

```
int main(int argc, char** strs) {
    char* fiveAs = make_string_of2('a', 5);
    printf("Five As: %s\n", fiveAs);
    char* sixBs = make_string_of2('b', 6);
    printf("Six Bs: %s\n", sixBs);
}
```

free(fiveAs);
free(sixBs);

calloc called? A: 1 B: 2 C: 3



free(pointer)

Takes a pointer (either interpretation – a struct reference or an array!) and tells calloc/malloc that the calloc()'ed space it refers to can be used again in the future. The pointer must not be used again after freeing it. free() should be called once for each time calloc() is used. Failing to free is called a **memory leak**.

```
#include <stdio.h>
#include <stdlib.h>

typedef struct AList {
    int* contents;
    int size;
    int capacity;
} AList;

AList* make_alist(int start_capacity) {

}

void expandCapacity(AList* alist) {

}

void add(AList* alist, int element) {

}

int get(AList* alist, int index) {

}

void print_alist(AList* alist) {
    int i = 0;
    for(i = 0; i < alist->size; i += 1) {
        printf("%d, ", alist->contents[i]);
    }
}

int main(int argc, char** args) {
    AList* a = make_alist(4);
    add(a, 5);
    add(a, 3);
    add(a, 1);
    printf("%d\n", get(a, 0));
    printf("%d\n", get(a, 1));
    printf("%d\n", get(a, 2));

    print_alist(a);

}
```

How many times is `calloc()` called in the `make_string2` example?

A: 1 B: 2

How much space is allocated for characters with `calloc()` in total in the `make_string2` example?

A: 11 chars B: 12 chars C: 13 chars D: Something else

A

```

AList* make_alist(int start_capacity) {
    AList* alist = calloc(start_capacity, sizeof(AList));
    int* contents = calloc(1, sizeof(int));
    alist->contents = contents;
    alist->size = 0;
    alist->capacity = start_capacity;
    return alist;
}

```

B

```

AList* make_alist(int start_capacity) {
    AList* alist = calloc(1, sizeof(AList));
    int* contents = calloc(start_capacity, sizeof(int*));
    alist->contents = contents;
    alist->size = 0;
    alist->capacity = start_capacity;
    return alist;
}

```

C

```

AList* make_alist(int start_capacity) {
    AList* alist = calloc(1, sizeof(AList));
    int* contents = calloc(start_capacity, sizeof(int));
    alist->contents = contents;
    alist->size = 0;
    alist->capacity = start_capacity;
    return alist;
}

```

D

```

AList* make_alist(int start_capacity) {
    AList* alist = calloc(1, sizeof(AList));
    int* contents = calloc(start_capacity, sizeof(int));
    alist->contents = contents;
    alist->size = 0;
    alist->capacity = start_capacity;
    return alist;
}

```

```
void add(AList* alist, int element) {
    if(alist.size >= alist.capacity) { expandCapacity(alist); }
    alist[alist->size] = element;
    alist->size += 1;
}
```

```
void add(AList* alist, int element) {
    if(this.size >= this.capacity) { expandCapacity(); }
    alist[alist->size] = element;
    alist->size += 1;
}
```

```
void add(AList* alist, int element) {
    if(alist->size >= alist->capacity) { expandCapacity(alist); }
    alist->contents[alist->size] = element;
    alist->size += 1;
}
```

```
void add(AList* alist, int element) {
    if(alist->size >= alist->capacity) { expandCapacity(alist); }
    alist->contents[alist->size] = element;
    alist->size += 1;
}
```