

Demonstration of safe string concatenation in C using `strncat()`

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

int main() {
    char s1[] = "security";
    char s2[15] = "software";
    char s3[10] = "";

    printf("Before strncat operations...\n");
    printf("s1: \"%s\" size: %zu length: %zu\n", s1, sizeof(s1), strlen(s1));
    printf("s2: \"%s\" size: %zu length: %zu\n", s2, sizeof(s2), strlen(s2));
    printf("s3: \"%s\" size: %zu length: %zu\n", s3, sizeof(s3), strlen(s3));

    strncat(s2, s1, sizeof(s2)-strlen(s2)-1);           // append s1 to s2
    strncat(s3, s1, sizeof(s3)-strlen(s3)-1);           // append s1 to s3
    strncat(s3, s2, sizeof(s3)-strlen(s3)-1);           // append s2 to s3

    printf("After strncat operations...\n");
    printf("s1: \"%s\" size: %zu length: %zu\n", s1, sizeof(s1), strlen(s1));
    printf("s2: \"%s\" size: %zu length: %zu\n", s2, sizeof(s2), strlen(s2));
    printf("s3: \"%s\" size: %zu length: %zu\n", s3, sizeof(s3), strlen(s3));
}
```

Let's assume the storage for arrays s1, s2, and s3 is allocated in the order of declarations in the source code (high memory address to low memory address).

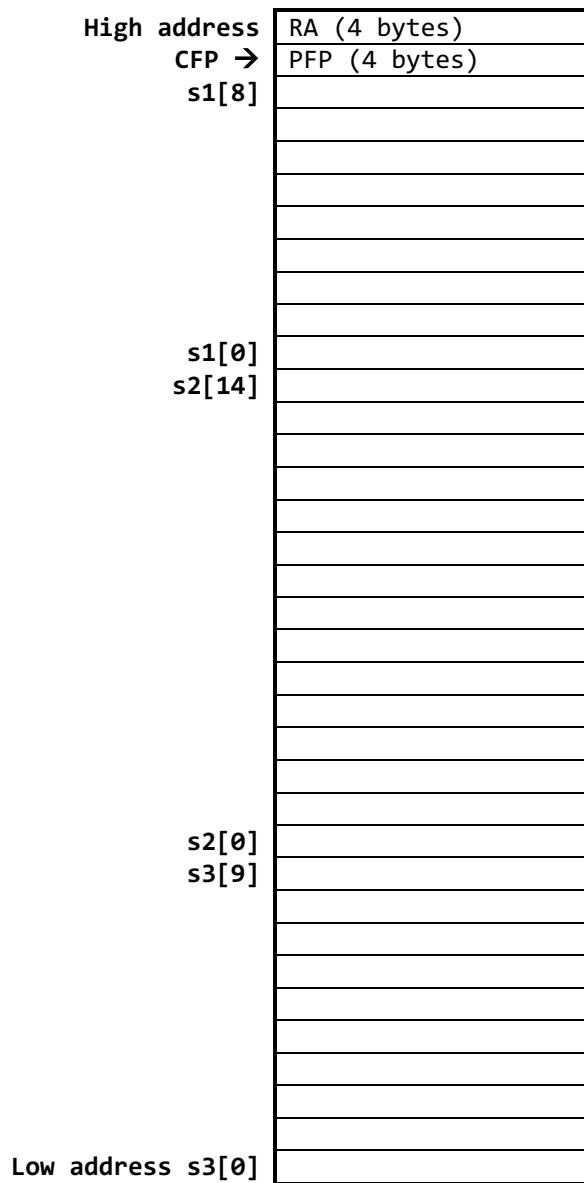
Step 1: Show the stack frame contents BEFORE call to `strncat` function (left table on next page)

Step 2: Use the before call stack frame contents to determine the output produced by the first three print statements.

Step 3: Show the stack frame contents AFTER call to `strncat` function (right table on next page)

Step 4: Use the after call stack frame contents to determine the output produced by the last three print statements.

Stack frame (before call to `strncat`)



Stack frame (after call to `strncat`)

