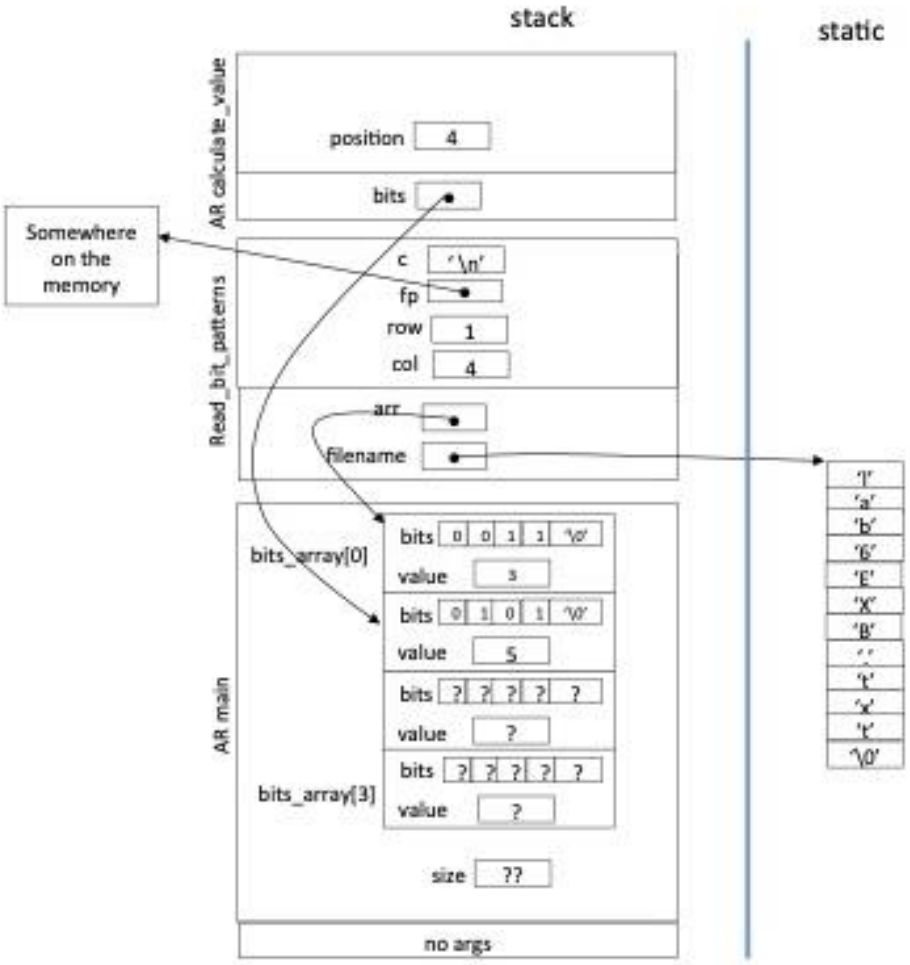
ENSF 337: Programming Fundamentals for Software and Computer
Lab 6 - Fall 2022 - Solutions

Written by: M. Moussavi, PhD, PEng

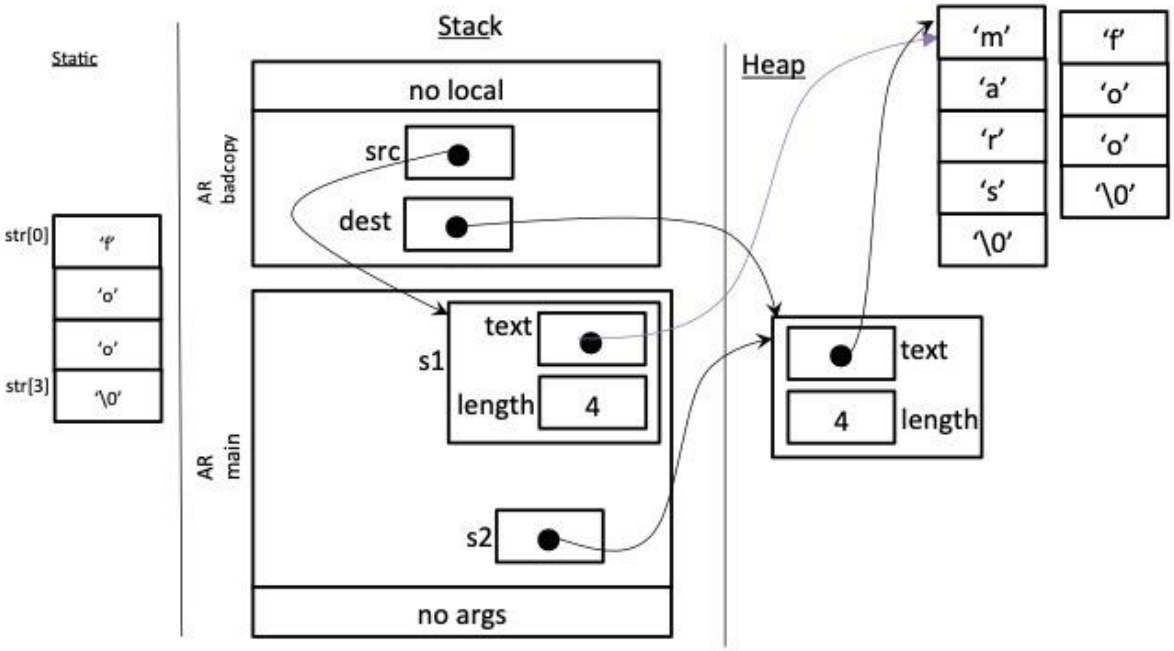
Exercise A: Draw AR Diagrams:



Exercise B: Writing into a Text File

```
void display_multiple_column(const IntVector *intV, int col, const char* output_filename){
    FILE *fp = fopen (output_filename, "w");
    if(fp == NULL){
        fprintf(stderr, "Sorry cannot open the binary file %s.", output_filename);
        exit(1);
    }

    if(col > intV ->number_of_data)
        col = intV ->number_of_data;

    for (int i = 1; i <= intV ->number_of_data; i++ ) {
        fprintf(fp,"%10d", intV ->storage[i-1]);
        if(i % col == 0)
            fprintf(fp,"\n");
    }

    fclose(fp);
}
```

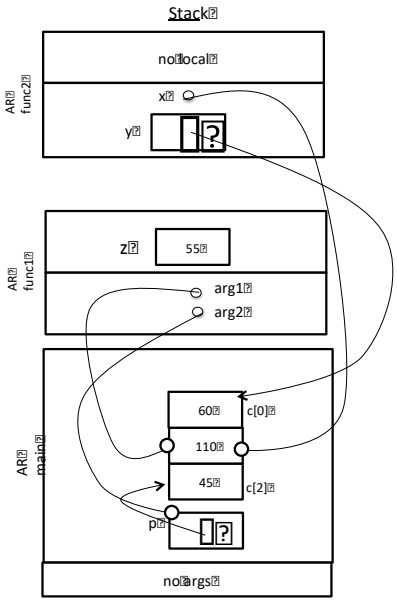
Exercise C: Allocation of Memory on the Heap



Exercise D: String Manipulation Using Dynamic Allocation

```
void String_append(String *dest, const String* source){
    if(source -> dynamic_storage == NULL || source ->dynamic_storage[0] == '\0')
        return;

    unsigned long new_length = dest -> length + source -> length;

    char* new_storage = malloc(new_length+1);
    if(new_storage == NULL){
        printf("malloc failed: Memory was unavailable...\n");
        exit(1);
    }

    strcpy(new_storage, dest -> dynamic_storage);
    strcat(new_storage, source -> dynamic_storage);

    if(dest -> dynamic_storage != NULL)
        free (dest -> dynamic_storage);

    dest -> dynamic_storage = new_storage;
    dest -> length = new_length;
}

void String_truncate(String *dest, int new_length){

    // using assert here is optional. Do NOT deduct mark if missing
    assert (new_length >= 0);
    if(new_length >= dest->length)
        return;

    char* new_storage = malloc(new_length+1);

    if(new_storage == NULL){
        printf("malloc failed: Memory was unavailable...\n");
        exit(1);
    }

    int i;

    for( i = 0  ; i < new_length; i++)
        new_storage[i] = dest->dynamic_storage[i];

    new_storage[i] = '\0';

    if(dest ->dynamic_storage != NULL)
        free(dest ->dynamic_storage);

    dest -> dynamic_storage = new_storage;
    dest->length = new_length;
}
```

Exercise E – Moving from C to C++:


Stack
no local
AR func2
x
y
?
z
55
AR func1
arg1
arg2
60
c[0]
110
45
c[2]
AR main
p
?
no args