1. We want to add an inventory system to a text adventure game so that the player can collect items. First, we'll implement a *bag* data structure that holds *items* in a linked list. Each `item_t` has an associated `weight`, and each `bag_t` has a `max_weight` that determines its holding capacity (see the definitions below). In the left text area for `item_node_t`, define the necessary data type to serve as the nodes in a **linked list** of items, and in the right text area, add any necessary fields to the `bag_t` definition.

```
typedef struct item {
    int weight;
    // other fields not shown
} item_t;
```

```
typedef struct item_node {
    // (a) FILL IN HERE



} item_node_t;
```

```
typedef struct bag {
    int max_weight;
    int current_weight;
    // add other fields necessary
    // (b) FILL IN HERE



} bag_t;
```

c) Complete the `add_item()` function, which should add `item` into `bag` **only** if adding the item would not cause the weight of the bag contents to exceed the bag's `max_weight`. The function should return `0` if the item *could not* be added, or `1` if it succeeded. Be sure to update the bag's `current_weight`. You do not need to check if `malloc()` returns `NULL`. Insert the new item into the list wherever you wish.

```
int add_item(item_t *item, bag_t *bag) {
    if (
_____________________________________________________________ ) {
        return 0;
    }
    item_node_t *new_node =
_____________________________________________
    // Add more code below…




    return 1;
}
```

(d) Finally, we want an `empty_bag()` function that frees the bag's linked list but **NOT** the memory of the items themselves and **NOT** the bag itself. The bag should then be "reset", ready for `add_item`. Assume that the operating system immediately fills any freed memory with garbage. Fill in the functions below.

```
void empty_bag(bag_t *bag) {
    free_contents( ________________
);
    // FILL IN HERE




}
```

```
void free_contents( ____________
) {
    // FILL IN HERE




}
```

(e) Now suppose that we care about the order of `item`s in our `bag`. However, because we're clumsy, the only possible way for us to rearrange `item`s is to reverse their order in the list.

```
void reverse_list(bag_t *bag) {









}
```

2. Questions (a) and (b) refer to the C code to the right.

```
#define val 16
char arr[] = "foo";
void foo(int arg){
    char *str = (char *) malloc (val);
    char *ptr = arr;
}
```

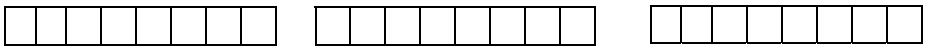
a) In which memory sections (code, static, heap, stack) do the following reside?

`arg` _____ `arr` _____ `*str` _____ `val` _____ (bonus) `*arr` _____

b) Name a C operation that would treat `arr` and `ptr` differently:
_____

c) Which of the best-, first-, next-fit schemes would succeed for **all 5** of the following sequence of `malloc` and `free` requests on a `malloc`-able region of memory only 8 bytes long? Circle those that would and show the resulting contents of memory for each one. E.g., After the "`a=malloc(4)`" call, all schemes should have the leftmost 4 boxes labeled "`a`".

```
a = malloc(4); b = malloc(1); free(a); c = malloc(3); d = malloc(4);
```



best-fit first-fit next-fit