

More Final Exam Study Questions

Here are a few more questions for you to consider courtesy of Vinay (he gave me a lot more). Numbers 2 and 3 are not questions I would include in an exam for this class, but they are good questions to consider. (I would not include #2 because I don't think I covered the operation of the preprocessor adequately for you to parse the syntax. I would not include #3 because it's GDB-specific, and while we could probably turn the question into something about designing useful interfaces for debugging tools, for our class it's too focused on the tool instead of the class content.)

1. XOR Linked Lists (from Wikipedia)

An XOR linked list is a variant that makes use of XOR operation to decrease memory requirements. An ordinary doubly-linked list stores addresses of the previous and next list items in each list node, requiring two address fields as shown on the left below. An XOR linked list compresses the same information into *one* address field by storing the bitwise XOR of the address for *previous* and the address for *next* in one field, as shown on the right.



In the XOR figure, \oplus denotes the XOR operation. The pointer values stored in the end nodes are XOR'd with NULL (0), so if A is the first element in the list above, its pointer value is B; similarly, if E is the last element, its pointer value is D.

Explain the advantages and disadvantages of an XOR linked list relative to a singly-linked list (which has the same memory requirements) and relative to a non-cyclic doubly-linked list (which uses twice as many pointers in the objects). For each comparison, discuss both the operations that are possible as well as the time required for the operations that both approaches support.

2. Putting the Preprocessor to Work

What is the output of the following code when you try it with the structure mentioned below. Explain the output and the code.

```
#define X(type, field) ((unsigned long) &(((type *) 0)->field))
struct A {
    int a;
    float b;
    char c;
};
X (A, a);
X (A, b);
X (A, c);
```

3. GDB Commands

What is the difference between the `step` and `next` commands in GDB?