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Critical Response Questions – Chapter 13

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1. Similarities between an array and a stack

- Both store multiple values of the same data type
- Both allow indexed storage in memory
- Both have a fixed size when implemented with an array
- A stack is often implemented using an array

2. How a stack is used in compiler software

A compiler uses a stack to:

- Track function calls and returns
- Match parentheses, brackets, and braces
- Evaluate expressions (such as postfix expressions)
- Store temporary values during parsing

Stacks work well here because the most recent operation must be completed first.

3. Stack output question

Code execution (LIFO behavior):

```
Stack s = new Stack(10);

s.push(5);

s.push(8);

int x = s.pop();   // x = 8

s.push(x);         // push 8

s.push(12);

s.push(13);

int y = s.pop();   // y = 13

System.out.println(x + " " + y);
```

Output:

```
8 13
```

```
y = s.pop();       // y = 12

x = s.top();       // x = 8

System.out.println(x + " " + y);
```

Output:

```
8 12
```

4. Hot plate problem analogy

This situation is like a stack because:

- New plates are placed on top
- Plates are removed from the top
- The last plate added is the first used

This is LIFO (Last-In, First-Out) behavior.

5. Queue output question

Code execution (FIFO behavior):

```
Queue q = new Queue(10);

q.enqueue(5);

q.enqueue(8);

int x = q.dequeue();   // x = 5

q.enqueue(x);          // enqueue 5

q.enqueue(12);
```

```
q.enqueue(13);

int y = q.dequeue();   // y = 8

System.out.println(x + " " + y);
```

Output:

```
5 8
```

```
y = q.dequeue();       // y = 5

x = q.front();         // x = 12

System.out.println(x + " " + y);
```

Output:

```
12 5
```

6. Difference between FIFO and LIFO

- FIFO (First-In, First-Out) → Queue
  - First item added is the first removed
- LIFO (Last-In, First-Out) → Stack
  - Last item added is the first removed

7. Two real-world queue examples

- Cars waiting at a drive-through
- Print jobs waiting in a printer queue

True / False

8. Determine true or false

a) False
A stack has only a top, not front and rear.

b) True
A stack can be emptied by popping all items.

c) False
Top refers to the most recently pushed item, not the first.

d) False
isEmpty() returns a boolean, not an int.

e) True
A queue can store multiple items.

f) False
Removals are made at the front, not the rear.

g) False
enqueue adds to the rear, not the front.

h) True
The first item in a linked list is called the head.

i) False
A node refers to an item in a linked list, not a stack.

j) False
Stacks and queues do not use a length operation; they use size.

k) True
In a linked list, the tail points to null.