Problem 1. Select the running time for each of the following vector methods.

- Accessing an element of the vector (via operator[]). □ Θ(1) □ Θ(n)
- Adding an element to the back of the vector (via push_back). □ O(1) □ O(n)
- Removing an element from the back of the vector (via pop_back). □ Θ(1) □ Θ(n)
- Removing an element from the front of the vector (via erase). □ Θ(1) □ Θ(n)

Problem 2. Complete the following function that replaces every element of a vector V with the sum of the elements of V:

```cpp
void replace_with_sum(vector<int> _____V)
{
    if (V.size() == _____)
        return;

    int sum = 0;
    for (int x : _____)
        sum += x;

    for (int i = 0; i < V._____(); ++i)
        V[i] = _____;
}
```

For instance, the following tests should pass:

```cpp
vector<int> V{1, 2, 3};
replace_with_sum(V);
test(V.size() == 3);
test(V[0] == 6);
test(V[1] == 6);
test(V[2] == 6);
```

Let n be the length of V.
The running time of replace_with_sum is: □ Θ(1) □ Θ(n) □ Θ(n^2)
Problem 3. Complete the following function that replaces each element of a vector V with two copies of the element:

```cpp
void duplicate(vector<_____> &V) {
    vector<string> C = V;
    V.clear();
    while (C.size() > 0) {
        V.push_back(C[_____]);
        V.push_back(C[_____]);
        C.erase(0);
    }
}
```

For instance, the following tests should pass:

```cpp
vector<string> V{"dog", "cat", "bird"};
duplicate(V);
test(V.size() == 6);
test(V[0] == "dog");
test(V[1] == "dog");
test(V[2] == "cat");
test(V[3] == "cat");
test(V[4] == "bird");
test(V[5] == "bird");
```

Let $n$ be the length of $V$.
The running time of `duplicate` is: $\boxed{□}$ $\Theta(1)$ $\boxed{□}$ $\Theta(n)$ $\boxed{□}$ $\Theta(n^2)$
Problem 4. Complete the following template function that returns the sum of the elements of an array $A$ of length $n$:

```cpp
template <typename _____>
_____ sum(_____* A, int n)
{
    if (n == 0)
        return _____();

    _____ tot = A[0];

    for (int i = 1; i < n; ++i)
        _____ += A[i];

    return _____;
}
```

For instance, the following tests should pass:

```cpp
int A[] {1, 2, 3};
test(sum(A, 3) == 6);
test(sum(B, 3) == "dogcatbird");
```

The running time of $\text{sum}$ is: □ $\Theta(1)$   □ $\Theta(n)$   □ $\Theta(n^2)$