11. **Documentation:** Write documentation for the smart contracts, detailing how to deploy, interact with, and utilize the functionalities of both the ERC-20 token and the contract factory.

Ans:

**ExpirableERC20Token Overview:**

The `ExpirableERC20Token` contract is an ERC-20 compliant token with an added functionality of an expiry date for each minted batch. The token allows the owner to mint tokens with a specified expiry date and ensures that transfers are only allowed before the token expiration.

**Deployment**

Deploy the “ExpirableERC20Token” contract with the following parameters:

- name: The name of the token.

- symbol: The symbol or ticker of the token.

- initialHolder: The address that initially holds the entire token supply.

- initialSupply: The initial supply of tokens for the specified `initialHolder`.

Example:

ExpirableERC20Token myToken = new ExpirableERC20Token("Shihab", "SSU", msg.sender, 1000000);

**Minting Tokens with Expiry**

Mint new tokens with an expiry date using the “mintWithExpiry” function. Only the owner can perform this action.

- to: The address to which the tokens will be minted.

- value: The quantity of tokens to mint.

- expiryDate: The expiration timestamp for the minted tokens.

Example:

myToken.mintWithExpiry(addressToMint, 500, block.timestamp + 86400); // Minting 500 tokens expiring in 1 day

**Token Transfer**

Transfer tokens using the standard ERC-20 “transfer” and “transferFrom” functions. These functions automatically check the token expiry before allowing transfers.

Example:

myToken.transfer(receiverAddress, 200);

**Checking Token Validity**

Check whether a token is still valid using the “isTokenValid” function.

- owner: The owner's address.

- value: The quantity of tokens to check.

Example:

bool isValid = myToken.isTokenValid(ownerAddress, 200);

**TokenFactory Overview:**

The “TokenFactory” contract is a factory contract responsible for creating new instances of `ExpirableERC20Token`. Only the owner of the factory contract can create new tokens.

**Deployment**

Deploy the “TokenFactory” contract.

Example:

TokenFactory tokenFactory = new TokenFactory();

**Creating Tokens**

Create new tokens using the `createToken` function.

- name: The name of the token.

- symbol: The symbol or ticker of the token.

- initialSupply: The initial supply of tokens for the specified `msg.sender`.

- expiryDate: The expiration timestamp for the minted tokens.

- batchId: An identifier for the batch of tokens.

- quantity: The quantity of tokens to mint initially.

Example:

tokenFactory.createToken("New Token", "NT", 1000000, block.timestamp + 604800, 1, 500);

This will create a new `ExpirableERC20Token` with the specified parameters and mint 500 tokens to the owner (`msg.sender`).