Solana Auditors Bootcamp

1. Intro & Advanced Anchor

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About us

Blockchain security audits 🔎

Development of open source security tools 👩‍💻

Onboarding developers to blockchain 🎓

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We work with

1inch
LIDO
Safe
AXELAR
LayerZero.
Trader Joe
PENDLE
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Grants

ethereum foundation
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SOLANA FOUNDATION

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What is this course about ?

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The Course

- Advanced Anchor
- Integration Tests and Unit Tests
- Fuzzing with Trident I
- Fuzzing with Trident II
- Security Best Practices
- Common Vulnerability Vectors
- Capture the Flag

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What this course is not about ?

- Introduction to Rust
- Introduction to Solana
- Introduction to Blockchain

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Advanced Anchor Framework

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Agenda

- How Anchor improves Vanilla Solana ?
- What is the #[program] ?
- What is the #[derive(Accounts)] ?
- What is the #[account] ?
- Why are the Account types important ?
- What are all the Account Constraints ?
- What is the Anchor IDL ?

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What is Vanilla Solana ?

Vanilla Solana

vanilla-solana.rs

```rust
// declare and export the program's entrypoint
entrypoint!(process_instruction);

// program entrypoint's implementation
pub fn process_instruction(
    _program_id: &Pubkey,
    _accounts: &[AccountInfo],
    _instruction_data: &[u8],
) -> ProgramResult {
    // log a message to the blockchain
    msg!("Hello, world!");

    // gracefully exit the program
    Ok(())
}
```

Anchor

Anchor

```rust
use anchor_lang::prelude::*;

declare_id!("HrxxFK82k8J88kUvDZvTZHnqCVbeyjvebwfUQHwET4B7");

#[program]
pub mod anchor_solana {
    use super::*;

    pub fn initialize(ctx: Context<Initialize>) -> Result<()> {
        Ok(())
    }
}

#[derive(Accounts)]
pub struct Initialize {}
```

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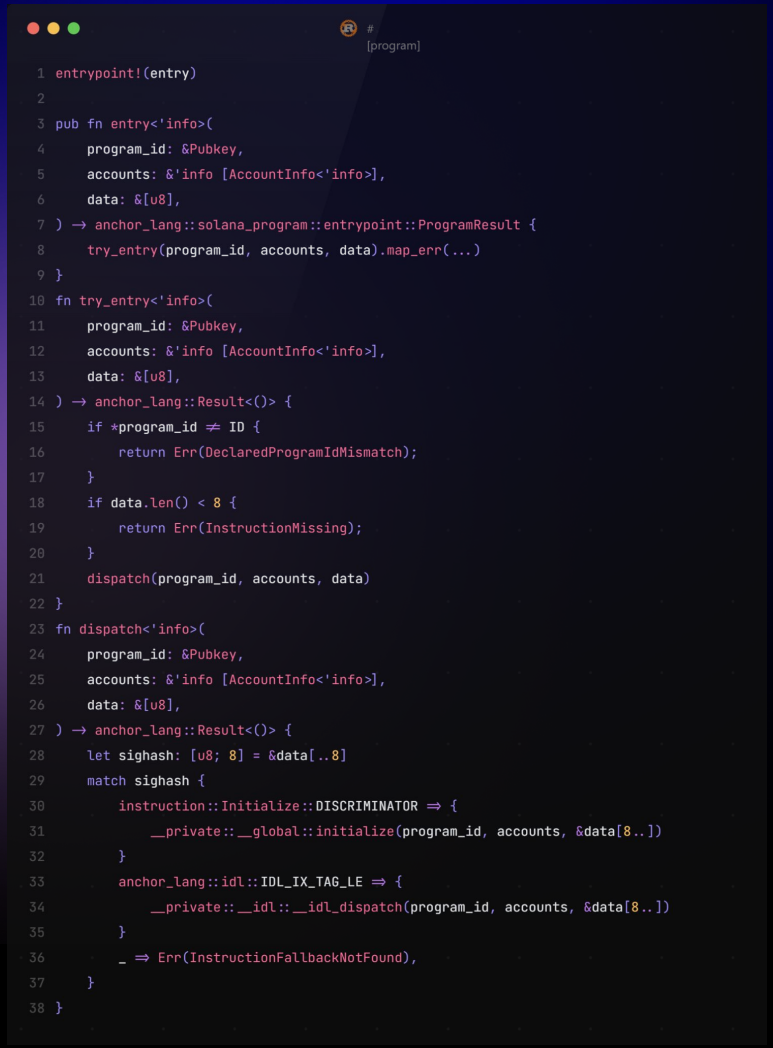
#[program]

- Encapsulates all the instruction **handlers that your program supports**.
- Encapsulates all the instructions **handlers for IDL manipulation**.
- Supports custom error types for **robust error management**.
- Works in conjunction with **#[derive(Accounts)]**.



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#[derive(Accounts)]

- **Validate the accounts** passed to the instruction handlers.
- **Deserializes** Account data.
- Allows specifying various **constraints**, such as **#[account(init)]**.
- Generates **CPI struct** of the Accounts.

#[derive(Accounts)]

```rust
impl<'info> anchor_lang::Accounts<'info, InitializeBumps> for Initialize<'info>
where
    'info: 'info,
{
    fn try_accounts(
        __program_id: &Pubkey,
        __accounts: &mut &'info [AccountInfo<'info>],
        __ix_data: &[u8],
        __bumps: &mut InitializeBumps,
    ) -> anchor_lang::Result<Self> {
        let signer: Signer = anchor_lang::Accounts::try_accounts(
            ...
        ).map_err(...)?;

        let system_program: anchor_lang::accounts::program::Program<System> =
            anchor_lang::Accounts::try_accounts(
                ...
            ).map_err(...)?;

        Ok(Initialize {
            signer,
            system_program,
        })
    }
}
```

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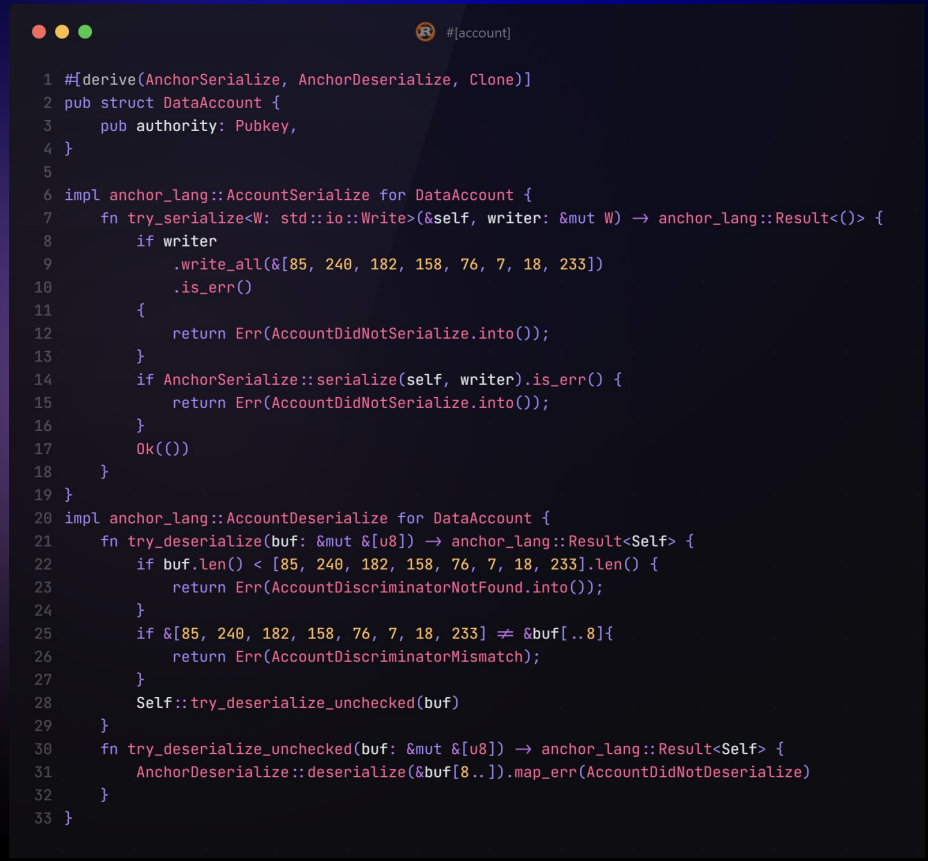
#[account]

- Handles the **Serialization** and **Deserialization** of the Account.
- Handles the **DISCRIMINATOR** creation and check.
- Defines the **Account owner** (i.e. your program).



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Account Types

Account
- Serialization + Deserialization + Owner

Account Info
- -

Account Loader
- Zero copy deserialization

Boxed
- based on Inner Type

Interface
- Program Validation (from set)

Interface Account
- Serialization + Deserialization + Owner(from set)

Option
- based on Inner Type

Program
- Program Validation

Signer
- Signer Validation

System Account
- Owner (System Program)

Sysvar
- Sysvar + Deserialization

Unchecked Account
- -

Account Types Docs

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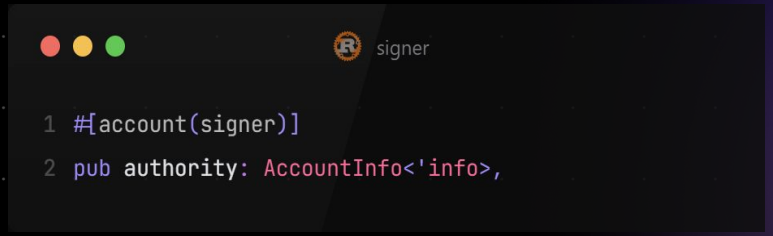
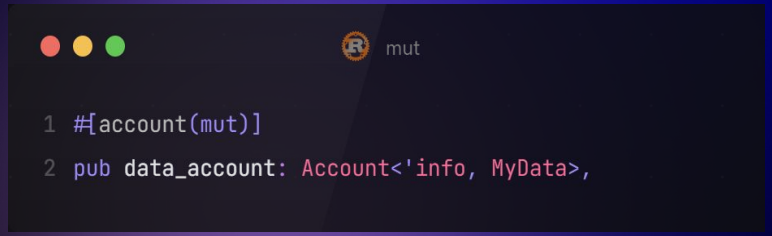
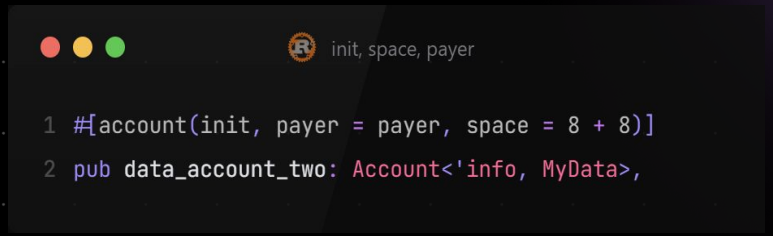
Account Constraints - Normal



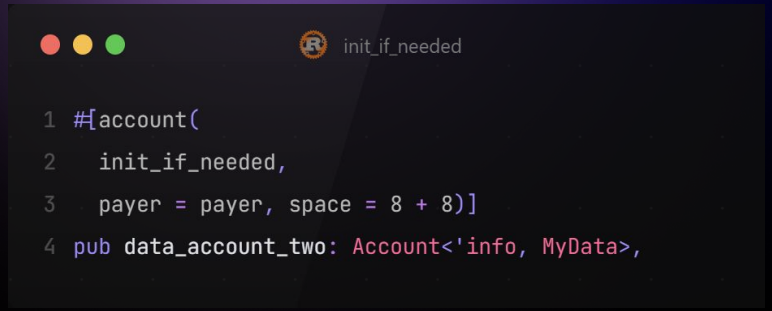
signer



mut



init, space, payer



init_if_needed

Account Constraints
Normal

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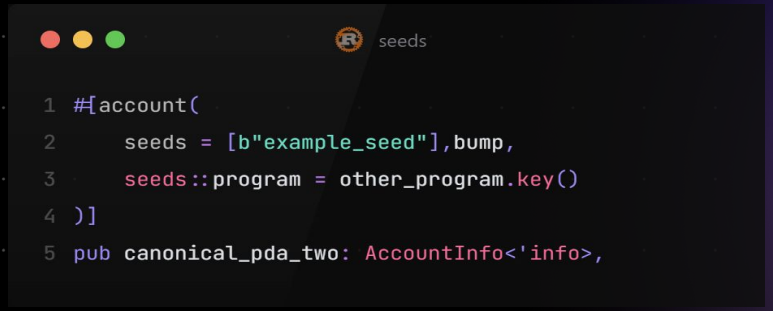
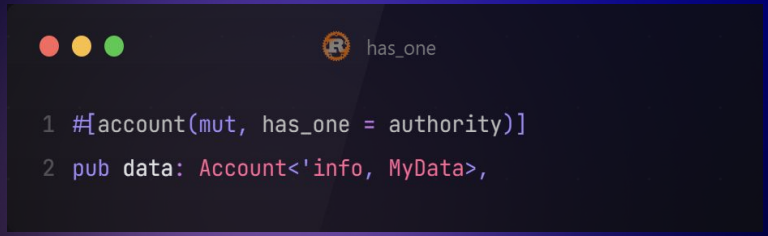
Account Constraints - Normal

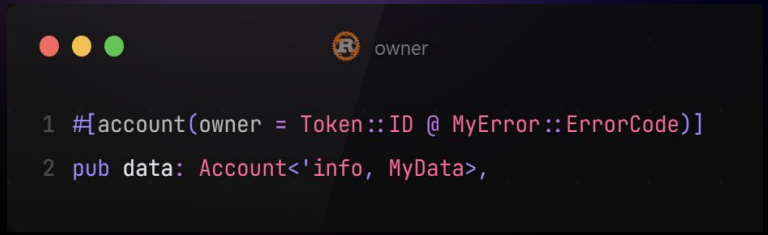


seeds



has_one

address



owner

Account Constraints
Normal

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Account Constraints - Normal

executable

```
1 #[account(executable)]
2 pub my_program: AccountInfo<'info>
```

executable

rent_exempt

```
1 #[account(zero, rent_exempt = skip)]
2 pub skipped_account: Account<'info, MyData>,
```

rent_exempt

zero

```
1 #[account(zero)]
2 pub my_account: Account<'info, MyData>
```

zero

close

```
1 #[account(mut, close = receiver)]
2 pub data_account: Account<'info, MyData>,
```

close

Account Constraints
Normal

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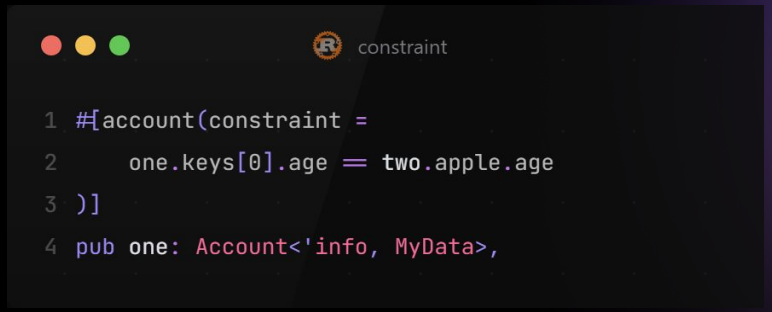
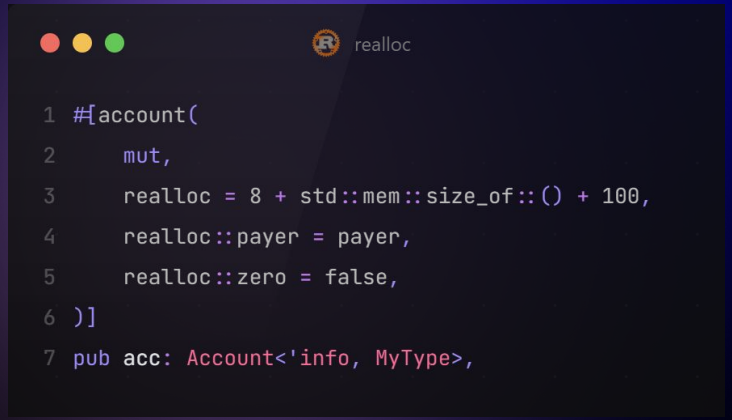
Account Constraints - Normal



constraint



realloc

Account Constraints
Normal

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Account Constraints - SPL

Account Constraints SPL

Token Account

Token Account

```
#[account(
    init,
    payer = payer,
    token::mint = mint,
    token::authority = payer,
)]
pub token: Account<'info, TokenAccount>,
```

Mint

Mint

```
#[account(
    init,
    payer = payer,
    mint::decimals = 9,
    mint::authority = payer,
    mint::freeze_authority = payer
)]
pub mint_two: Account<'info, Mint>,
```

Associated Token Account

Associated Token Account

```
#[account(
    init,
    payer = payer,
    associated_token::mint = mint,
    associated_token::authority = payer,
)]
pub token: Account<'info, TokenAccount>,
```

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Anchor IDL

- The IDL follows a standardized JSON schema.
- The IDL file includes detailed information about each instruction in the program.
- The IDL provides a description of each account type used in the program.
- Front-end applications and other client tools can use the IDL to interact with the Solana program without needing to manually define the program's interface.

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Recap

- #[program]
- #[derive(Accounts)]
- #[account]
- Anchor account Types
- Anchor account Constraints - Normal
- Anchor account Constraints - SPL
- IDL
- anchor expand

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Thanks for your attention!

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