



# SMART CONTRACT AUDIT

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PREPARED FOR

**STAKE LOUNGE**



# INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	Stake Lounge
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Contract	0x2f06eA277F97f81591A269c6F4dD3d1e061F80De
Blockchain	Arbitrum Chain
Centralization	Active ownership
Commit	c747452997157c40d64edcf76aa703692771ed10
Website	<a href="https://www.stakelounge.io/">https://www.stakelounge.io/</a>
Telegram	<a href="https://t.me/+3D2oOlkbV_M5MWZk/">https://t.me/+3D2oOlkbV_M5MWZk/</a>
X (Twitter)	<a href="https://x.com/stakelounge/">https://x.com/stakelounge/</a>
Report Date	November 27, 2023

 Verify the authenticity of this report on our website: <https://www.github.com/interfinetwork>



## EXECUTIVE SUMMARY

InterFi has performed the automated and manual analysis of solidity codes. Solidity codes were reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Critical <span style="color: red;">●</span>	Major <span style="color: orange;">●</span>	Medium <span style="color: yellow;">●</span>	Minor <span style="color: green;">●</span>	Unknown <span style="color: brown;">●</span>
Open	0	0	2	5	1
Acknowledged	0	0	1	0	0
Resolved	0	0	0	0	0
Important Privileges	Transfer Fees, Set Bankroll, Withdraw, Withdraw Tokens				

**i** Smart contracts depend on Bankroll contract to function. Bankroll contract is not included in the audit process due to being out-of-scope.

**i** Please note that smart contracts deployed on blockchains aren't resistant to exploits, vulnerabilities and/or hacks. Blockchain and cryptography assets utilize new and emerging technologies. These technologies present a high level of ongoing risks. For a detailed understanding of risk severity, source code vulnerability, and audit limitations, kindly review the audit report thoroughly.

**i** Please note that centralization privileges regardless of their inherited risk status - constitute an elevated impact on smart contract safety and security.



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## SCOPE OF WORK

InterFi was consulted by Stake Lounge to conduct the smart contract audit of their solidity source codes. The audit scope of work is strictly limited to mentioned solidity files only:

- Base.sol
- Dice.sol

Public Contract Link	
<a href="https://arbiscan.io/address/0x2f06eA277F97f81591A269c6F4dD3d1e061F80De#code">https://arbiscan.io/address/0x2f06eA277F97f81591A269c6F4dD3d1e061F80De#code</a>	
Contract Name	Dice.sol
Compiler Version	0.8.0
License	MIT

 If source codes are not deployed on the main net, they can be modified or altered before main-net deployment. Deployment status of above files is unknown.

 Audit scope is confined to solidity files explicitly mentioned above. Any dependencies such as external contracts, libraries, interfaces, are treated as black boxes. Their functional correctness is presumed, and they are not included in the audit process.



# AUDIT METHODOLOGY

Smart contract audits are conducted using a set of standards and procedures. Mutual collaboration is essential to performing an effective smart contract audit. Here's a brief overview of InterFi's auditing process and methodology:

## CONNECT

- The onboarding team gathers source codes, and specifications to make sure we understand the size, and scope of the smart contract audit.

## AUDIT

- Automated analysis is performed to identify common contract vulnerabilities. We may use the following third-party frameworks and dependencies to perform the automated analysis:
  - Remix IDE Developer Tool
  - Open Zeppelin Code Analyzer
  - SWC Vulnerabilities Registry
  - DEX Dependencies, e.g., Pancakeswap, Uniswap
- Simulations are performed to identify centralized exploits causing contract and/or trade locks.
- A manual line-by-line analysis is performed to identify contract issues and centralized privileges.

We may inspect below mentioned common contract vulnerabilities, and centralized exploits:

Centralized Exploits	<ul style="list-style-type: none"><li>○ Token Supply Manipulation</li><li>○ Access Control and Authorization</li><li>○ Assets Manipulation</li><li>○ Ownership Control</li><li>○ Liquidity Access</li><li>○ Stop and Pause Trading</li><li>○ Ownable Library Verification</li></ul>
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## Common Contract Vulnerabilities

- Integer Overflow
- Lack of Arbitrary limits
- Incorrect Inheritance Order
- Typographical Errors
- Requirement Violation
- Gas Optimization
- Coding Style Violations
- Re-entrancy
- Third-Party Dependencies
- Potential Sandwich Attacks
- Irrelevant Codes
- Divide before multiply
- Conformance to Solidity Naming Guides
- Compiler Specific Warnings
- Language Specific Warnings

**REPORT**

- The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.
- The client's development team reviews the report and makes amendments to solidity codes.
- The auditing team provides the final comprehensive report with open and unresolved issues.

**PUBLISH**

- The client may use the audit report internally or disclose it publicly.

 It is important to note that there is no pass or fail in the audit, it is recommended to view the audit as an unbiased assessment of the safety of solidity codes.



## RISK CATEGORIES

Smart contracts are generally designed to hold, approve, and transfer tokens. This makes them very tempting attack targets. A successful external attack may allow the external attacker to directly exploit. A successful centralization-related exploit may allow the privileged role to directly exploit. All risks which are identified in the audit report are categorized here for the reader to review:

Risk Type	Definition
Critical 	These risks could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Major 	These risks are hard to exploit but very important to fix, they carry an elevated risk of smart contract manipulation, which can lead to high-risk severity.
Medium 	These risks should be fixed, as they carry an inherent risk of future exploits, and hacks which may or may not impact the smart contract execution. Low-risk re-entrancy-related vulnerabilities should be fixed to deter exploits.
Minor 	These risks do not pose a considerable risk to the contract or those who interact with it. They are code-style violations and deviations from standard practices. They should be highlighted and fixed nonetheless.
Unknown 	These risks pose uncertain severity to the contract or those who interact with it. They should be fixed immediately to mitigate the risk uncertainty.

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.





## CENTRALIZED PRIVILEGES

Centralization risk is the most common cause of cryptography asset loss. When a smart contract has a privileged role, the risk related to centralization is elevated.

There are some well-intended reasons have privileged roles, such as:

- Privileged roles can be granted the power to pause() the contract in case of an external attack.
- Privileged roles can use functions like, include(), and exclude() to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale and to list on an exchange.

Authorizing privileged roles to externally-owned-account (EOA) is dangerous. Lately, centralization-related losses are increasing in frequency and magnitude.

- The client can lower centralization-related risks by implementing below mentioned practices:
- Privileged role's private key must be carefully secured to avoid any potential hack.
- Privileged role should be shared by multi-signature (multi-sig) wallets.
- Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.
- Renouncing the contract ownership, and privileged roles.
- Remove functions with elevated centralization risk.

 Understand the project's initial asset distribution. Assets in the liquidity pair should be locked. Assets outside the liquidity pair should be locked with a release schedule.



## AUTOMATED ANALYSIS

Symbol	Definition
	Function modifies state
	Function is payable
	Function is internal
	Function is private
	Function is important

```

| **IBankroll** | Interface | |||
|  | getIsValidWager | External ! | |NO ! |
|  | isAddressSuspended | External ! | |NO ! |
|  | owner | External ! | |NO ! |
|  | transferPayout | External ! |  |NO ! |
|  | isGameApproved | External ! | |NO ! |
|  | getStoppedStatus | External ! | |NO ! |
|||||
| **IVRFCoordinatorV2** | Interface | VRFCoordinatorV2Interface |||
|  | getFeeConfig | External ! | |NO ! |
|||||
| **Base** | Implementation | ReentrancyGuard, Ownable |||
|  | _transferPayout | Internal   | |
|  | _transferWager | Internal   | |
|  | _transferToBankroll | Internal   | |
|  | getVRFFee | Public ! | |NO ! |

```



| L | **transferFees** | External ! | 🔴 | nonReentrant onlyOwner |

| L | **\_refundExcessValue** | Internal 🔒 | 🔴 | |

| L | **setBankroll** | External ! | 🔴 | onlyOwner |

| L | **\_payVRFFee** | Internal 🔒 | 🔴 | |

|||||

| **\*\*Dice\*\*** | Implementation | Base, VRFCConsumerBaseV2 |||

| L | <Constructor> | Public ! | 🔴 | VRFCConsumerBaseV2 |

| L | **getDiceSessionResults** | External ! | | NO ! |

| L | **playDice** | External ! | 💰 | nonReentrant |

| L | **\_requestRandomWords** | Internal 🔒 | 🔴 | |

| L | **rawFulfillRandomWords** | External ! | 🔴 | NO ! |

| L | **fulfillRandomWords** | Internal 🔒 | 🔴 | |

| L | **\_kellyWager** | Internal 🔒 | | |

| L | **Dice\_Refund** | External ! | 🔴 | nonReentrant |

| L | <Receive Ether> | External ! | 💰 | NO ! |

| L | <Fallback> | External ! | 💰 | NO ! |

| L | **withdraw** | External ! | 🔴 | onlyOwner |

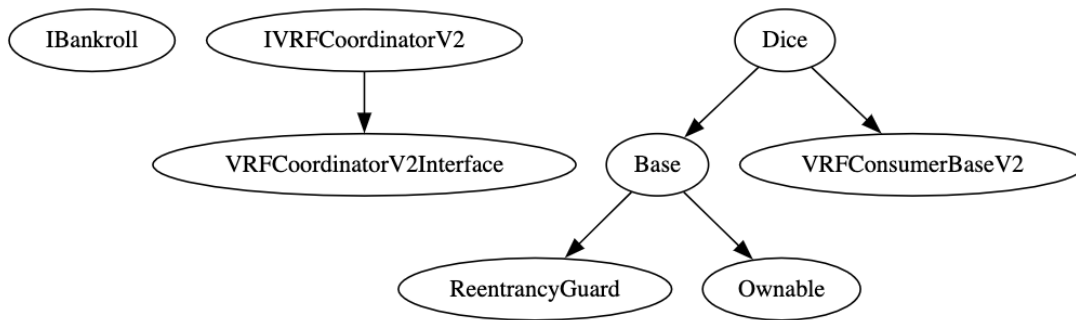
| L | **getMaxWager** | External ! | | NO ! |

| L | **getTokenBalance** | Public ! | | NO ! |

| L | **withdrawTokens** | External ! | 🔴 | onlyOwner |



## INHERITANCE GRAPH



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## MANUAL REVIEW

Identifier	Definition	Severity
STL-01	Privileged role transfers VRFFees	Medium ●
STL-02	Privileged role withdraws contract balance	

Important onlyOwner centralized privileges are listed below:

```
transferFees()  
setBankroll()  
withdraw()  
withdrawTokens()
```

## RECOMMENDATION

Deployers', owners', and all other privileged roles' private-keys should be secured carefully. These entities can have a single point of failure that compromises the security of the project. Manage centralized and privileged roles carefully, review PAGE 09 for more information.



Identifier	Definition	Severity
LOG-01	Insufficient access control	Medium 🟡

Mentioned function should only be callable by VRF Coordinator to ensure that only valid random numbers provided by Chainlink VRF are processed. If inadequately restricted, it may allow unauthorized entities to trigger it.


```
rawFulfillRandomWords()
```

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## RECOMMENDATION

Ensure strict access control, e.g., checking `msg.sender` against the known VRF Coordinator address.



Identifier	Definition	Severity
LOG-02	Potential front-running	Minor 

Potential front-running happens when an attacker observes a transaction swapping tokens or adding liquidity without setting restrictions on slippage or minimum output amount. The attacker can manipulate the exchange rate by front-running a transaction to purchase assets and make profits by back-running a transaction to sell assets.

Functions like `requestRandomWords` in Dice contract, and dependence on `tx.gasprice` can be potential points of concern. Since Ethereum transactions are public in the mempool before being mined, malicious actors can attempt to front-run transactions if they can predict or benefit from the outcome.

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## RECOMMENDATION

Front-running is unavoidable on public blockchains. However, review logic to ensure that front-running does not provide major advantage, especially in the context of random number generation and betting outcomes.



Identifier	Definition	Severity
LOG-03	Re-entrancy	Medium 🟡

Below mentioned functions transfer funds or alter contract state, therefore they should be protected with re-entrancy guard:

`_transferPayout()`

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## RECOMMENDATION

Use Checks Effects Interactions pattern when handing over the flow to an external entity and/or guard functions against re-entrancy attacks. Re-entrancy guard is used to prevent re-entrant calls.

## ACKNOWLEDGEMENT

Stake Lounge team iterated that `_transferPayout` function has re-entrancy guard. *`_transferPayout` function implementation is in `Bankroll` contract, which is not audited due to being out-of-scope.*





Identifier	Definition	
LOG-04	Note regarding Chainlink VRF	

Chainlink VRF is a secure choice for randomness. However, look out for VRF service failures, and set fallback mechanisms in place.

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Identifier	Definition	Severity
COD-01	Use of tx.gasprice	Minor ●

Using tx.gasprice directly can make the transaction susceptible to manipulation and front-running attacks, as miners or other participants might manipulate the gas price for their benefit.

With introduction of EIP-1559, gas pricing in Ethereum has updated. It makes tx.gasprice less predictable and reliable.

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## RECOMMENDATION

Use stable and predictable method of calculating fees.



Identifier	Definition	Severity
COD-02	Timestamp manipulation via <code>block.timestamp</code>	Minor 

Be aware that the timestamp of the block can be manipulated by a miner. When the contract uses the timestamp to seed a random number, the miner can actually post a timestamp within 15 seconds of the block being validated, effectively allowing the miner to precompute an option more favorable to their chances.

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## RECOMMENDATION

To maintain block integrity, follow 15 seconds rule, and scale time dependent events accordingly.



Identifier	Definition	Severity
COD-05	Missing zero address validation	

Below mentioned functions are missing zero address input validation:

transferFees()

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## RECOMMENDATION

Validate if the modified address is dead(0) or not.



Identifier	Definition	Severity
COD-10	Direct and indirect dependencies	Unknown ●


Smart contract is interacting with third party protocols e.g., Market Makers, External Contracts e.g., ChainSpecificUtil, Bankroll, Web 3 Applications, Open Zeppelin tools. The scope of the audit treats these entities as black boxes and assumes their functional correctness. However, in the real world, all of them can be compromised, and exploited. Moreover, upgrades in these entities can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, etc.

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## RECOMMENDATION

Inspect third party dependencies regularly, and mitigate severe impacts whenever necessary.



Identifier	Definition	Severity
VOL-01	Irrelevant code	Minor 

In `transferFees`, there's a requirement that `msg.sender` must be Bankroll owner. This is redundant since `onlyOwner` modifier is also applied.

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## RECOMMENDATION

Remove redundant and dead code.



Identifier	Definition	Severity
COM-01	Floating compiler status	

Compiler is set to ^0.8.16

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## RECOMMENDATION

Pragma should be fixed to the version that you're indenting to deploy your contracts with.



Identifier	Definition	Severity
COM-04	Potential resource exhaustion errors	Minor 

Functions like `_requestRandomWords` and `fulfillRandomWords` may be gas-intensive in certain cases, and may throw out-of-gas errors.

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## RECOMMENDATION

Optimize gas-intensive transactions.





## DISCLAIMERS

InterFi Network provides the easy-to-understand audit of solidity source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. You agree that your access and/or use, including but not limited to any services, reports, and materials, will be at your sole risk on an as-is, where-is, and as-available basis. This audit report could include false positives, false negatives, and other unpredictable results.

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## ABOUT INTERFI NETWORK

InterFi Network provides intelligent blockchain solutions. We provide solidity development, testing, and auditing services. We have developed 150+ solidity codes, audited 1000+ smart contracts, and analyzed 500,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Velas, Oasis, etc.

InterFi Network is built by engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 4 core members, and 6+ casual contributors.

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