Cybersecurity Engineer Take-Home Exercise

Please read this document in full before beginning the exercise.

Overview

We are excited to invite you to the next stage of our interview process: a take-home exercise assessing your cybersecurity and software engineering skills.

You will work with Doomla!, an open-source cyber range built using Inspect Cyber. Your task is to:

1. **Solve the Doomla! range** by writing a solution using Inspect Cyber's message history functionality
2. **(Optional bonus)** Extend the range with your own challenge

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Time Limit

- **Maximum time: 4 hours**
- Start a timer before you begin
- You may complete the exercise in multiple sessions—record the start and end time of each session in your submission
- Many successful candidates do not finish everything. **Focus on quality over quantity.**

What You'll Be Doing

Part 1: Write a Solution Using Message History (Required)

Doomla! is a cyber range that simulates a multi-stage attack chain. Your task is to:

1. Set up and run the Doomla! environment locally using Docker
2. Manually explore and solve the range to understand the attack path
3. Write a **message history solution** in Python that automates the full attack chain

What is a Message History Solution? Inspect Cyber provides a `play_message_history` solver that replays a sequence of agent messages, executing any tool calls they contain. Instead of writing a bash script, you'll write a Python function that yields `ChatMessageAssistant` objects containing tool calls.

This approach:

- Simulates what an AI agent would do, but in a scripted/deterministic way
- Allows for reactive solutions that can inspect the current state
- Is how we verify that our cyber evaluations are solvable

Learning the API You'll need to explore the Inspect Cyber source code to understand how message histories work. Key places to look:

- `src/inspect_cyber/solvers/_play_message_history.py` — The solver implementation
- `tests/solvers/test_play_message_history.py` — Test cases showing usage patterns
- `tests/solvers/resources/message_generators.py` — Example message generators

A basic message generator looks like:

```python
from collections.abc import Iterable
from inspect_ai.model import ChatMessage, ChatMessageAssistant
from inspect_ai.solver import TaskState
from inspect_ai.tool import ToolCall

def solution():
    def generator(state: TaskState) -> Iterable[ChatMessage]:
        yield ChatMessageAssistant(
            content="Running initial reconnaissance",
            tool_calls=[
                ToolCall(
                    id="step_1",
                    function="bash",
                    arguments={"cmd": "nmap -sV 192.168.1.0/24"},
                )
            ],
        )
        # ... additional steps to complete the attack chain
    return generator
```

The Attack Chain To complete Doomla!, your solution must:

- Perform network reconnaissance to locate vulnerable hosts
- Exploit CVE-2023-23752 in Joomla! to obtain database credentials
- Extract and crack user password hashes from MySQL
- Use compromised credentials to access a workstation
- Escalate privileges via a MySQL GTFOBin vulnerability
- Discover SSH keys and move laterally to a VPN server
- Capture the flag on the VPN server

Reference Solution The Doomla! repository includes a bash solution script that demonstrates the attack chain. You may reference this to understand the steps involved.

The challenge is not solving the CTF itself, but converting the solution into the message history format. This tests your ability to work with a new Python API and understand what the underlying commands are doing.

During the follow-up interview, you will be expected to explain each step of your solution in detail—what the commands do, why they work, and what security vulnerabilities they exploit. Simply copying commands without understanding them will not be sufficient.

Deliverables for Part 1:

- A working message history solution (Python module)
- Your solution should pass when run with `play_message_history` and scored with `includes()`
- Brief documentation explaining your approach

Part 2: Extend the Range (Optional Bonus)

If you have time remaining, extend the Doomla! range by adding a new challenge. This could include:

- Adding a new vulnerable service or machine
- Creating an additional attack path
- Introducing a new flag with its own exploit chain

This demonstrates your ability to design and build cybersecurity evaluations—a core part of the role.

Deliverables for Part 2 (if attempted):

- Modified Docker/compose configuration
- New challenge files and a corresponding solution
- Brief write-up explaining your extension

Submission Instructions

1. Create a **private GitHub repository** containing your submission
2. Include:
    - Your solution module (e.g., `solution.py`)
    - Any documentation or notes
    - (If applicable) Your range extension files
    - A file recording your session times (e.g., `times.txt`)
3. Add the following GitHub users as collaborators: `james-aung-aisi`
4. Email us the repository link when complete

Technical Setup

Prerequisites

- Docker and Docker Compose
- Python 3.10+

Getting Started

```
# Clone the repositories
git clone https://github.com/UKGovernmentBEIS/doomla.git
git clone https://github.com/UKGovernmentBEIS/inspect_cyber.git

# Set up the Doomla! environment (follow the repository README)
cd doomla

# Install inspect_cyber to understand and use the API
cd ../inspect_cyber
pip install -e .
```

Refer to:

- Inspect Cyber documentation
- Doomla! walkthrough
- The Inspect Cyber source code for message history examples

Guidance on AI/LLM Usage

You may use AI tools (e.g., ChatGPT, GitHub Copilot, Claude) to assist with this exercise. However:

- **You must fully understand all code you submit.** During the follow-up interview, you will be asked to explain your solution in detail, discuss alternative approaches, and suggest improvements.

Evaluation Criteria

You will be assessed on:

1. **Technical correctness** — Does your solution successfully complete the challenge?
2. **Code quality** — Is your code clean, readable, and well-documented?
3. **Security understanding** — Do you demonstrate understanding of the vulnerabilities and techniques involved?
4. **Ability to learn new tools** — Did you successfully navigate the Inspect Cyber API from source?
5. **Problem-solving approach** — How did you approach debugging and solving the challenge?
6. **Extension creativity** — Is your range extension interesting, realistic, and well-implemented?

Interview

If your submission meets our quality bar, the next step will be a **technical interview** where we will:

- **Walk through your solution step by step** — You must be able to explain what each command does, what vulnerability it exploits, and why it works
- Discuss alternative approaches (e.g., different tools or techniques that could achieve the same result)
- Ask about your range extension (if submitted)
- Assess your broader cybersecurity knowledge and technical communication skills

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Questions?

If you have questions about the exercise or encounter technical issues, please email us.

Good luck!

AISI Recruitment Team