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COURSE: AI ASSISTED CODING

SPECILIZATION: CSE-AIML

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Task 1 – Project Proposal

- Students choose a real-world problem to solve with an AI-assisted application (e.g., ecommerce billing system, health monitoring dashboard, student attendance tracker).
- Prepare a project proposal including:
 - Objective
 - Features
 - Tools/technologies to be used

PROMPT: Develop a code to generate a python code Project Proposal • Students choose a real-world problem to solve with an AI-assisted application (e.g., ecommerce billing system, health monitoring dashboard, student attendance tracker). • Prepare a project proposal include
Expected output:

```
# -----
# Project Proposal Generator (AI-Assisted)
# -----



def generate_proposal(info):
    proposal = f"""
=====
PROJECT PROPOSAL DOCUMENT
=====

⭐ Project Title:
{info['title']}

⌚ Objective:
{info['objective']}

⭐ Key Features:
"""
    for i, f in enumerate(info['features'], 1):
        proposal += f"    {i}. {f}\n"
    proposal += f"""

🛠 Tools & Technologies:
"""
    for t in info['tools']:
        proposal += f"    • {t}\n"
    proposal += f"""

💡 Expected Output:
{info['expected_output']}
=====

End of Proposal
=====

"""
    return proposal

# -----
# 🏛 SAMPLE PROJECT (You can edit this section)
# -----
project_info = {
    "title": "AI-Assisted Student Attendance Tracker",
    "objective": "To build an automated student attendance system using face recognition and real-time",
    "features": [
        "Face recognition-based automatic attendance marking",
        "Daily/weekly/monthly attendance reports",
        "Dashboard showing attendance statistics",
        "Notifications for low attendance"
    ],
    "tools": [
        "Python",
        "OpenCV",
        "TensorFlow / Face Recognition Library",
        "SQLite / Firebase",
        "Streamlit for UI"
    ]
}
```

... =====
... PROJECT PROPOSAL DOCUMENT
... =====

⭐ Project Title:
AI-Assisted Student Attendance Tracker

⌚ Objective:
To build an automated student attendance system using face recognition and real-time data logging.

⭐ Key Features:
1. Face recognition-based automatic attendance marking
2. Daily/weekly/monthly attendance reports
3. Dashboard showing attendance statistics
4. Notifications for low attendance

❖ Tools & Technologies:
• Python
• OpenCV
• TensorFlow / Face Recognition Library
• SQLite / Firebase
• Streamlit for UI

🕒 Expected Output:
A fully working smart attendance system with live camera processing, automated marking, and a user-friendly dashboard.

=====
End of Proposal
=====

Task 2 – Application Design Use AI tools to assist in: o Designing system architecture diagrams. o Defining database schema (if needed).

Creating wireframes/UI mockups for frontend design PROMPT:

Generate a python code to develop an Application Design
Use AI tools to assist in: o Designing system architecture diagrams. o Defining database schema (if needed). o Creating wireframes/UI mockups for frontend design
Expected output:

```

# -----#
# AI-Assisted Application Design Generator (Offline Template)
# -----#
```

```

def generate_system_architecture(app):
    return f"""
=====
    SYSTEM ARCHITECTURE DIAGRAM
=====

    
    Frontend ({app['frontend']}) |  

    | API Calls  

    v  

    Backend API ({app['backend']}) |  

    v  

    Database Layer ({app['database']}) |
```

Additional Services:

- Authentication: {app['services'].get('auth', 'Not used')}
- Cloud Storage: {app['services'].get('storage', 'Not used')}

Terminal

```

def generate_database_schema(schema):
    result = "\n=====\n"
    for table, fields in schema.items():
        result += f"\n\tTable: {table}\n"
        for field, dtype in fields.items():
            result += f"\t\t{field}: {dtype}\n"
    return result
```

DATABASE SCHEMA\n=====

```

def generate_wireframes(ui):
    output = "\n=====\n"
    for screen, layout in ui.items():
        output += f"\n\tScreen: {screen}\n"
        output += "-----\n"
        for line in layout:
            output += line + "\n"
        output += "-----\n"
    return output
```

UI WIREFRAMES\n=====

```

# -----#
# SAMPLE APPLICATION (Change this to your project)
# -----#
app_info = {
    "name": "Smart Health Monitoring Dashboard",
    "frontend": "Streamlit",
    "backend": "FastAPI",
    "database": "MongoDB"
```

```

    password_hash": "Text"
},
"health_records": {
    "record_id": "String (PK)",
    "user_id": "String (FK)",
    "heart_rate": "Integer",
    "blood_pressure": "Text",
    "timestamp": "Datetime"
},
"predictions": {
    "prediction_id": "String (PK)",
    "user_id": "String (FK)",
    "risk_score": "Float",
    "ai_result": "Text",
    "timestamp": "Datetime"
}
}

ui_mockups = {
    "Login Screen": [
        "+-----+",
        "|      LOGIN PAGE      |",
        "| ----- |",
        "| Email: [_____] |",
        "| Pass: [_____] |",
        "|      ( Login Button ) |",
        "+-----+"
    ],
    "Dashboard": [
        "+-----+",
        "+-----+"
    ]
}

Additional Services:
...
- Authentication: JWT Authentication
- Cloud Storage: AWS S3 Buckets
- AI/ML Models: Heart-Risk Prediction Model

=====
DATABASE SCHEMA
=====

❖ Table: users
- user_id: String (Primary Key)
- name: Text
- email: Text
- password_hash: Text

❖ Table: health_records
- record_id: String (PK)
- user_id: String (FK)
- heart_rate: Integer
- blood_pressure: Text
- timestamp: Datetime

❖ Table: predictions
- prediction_id: String (PK)
- user_id: String (FK)
- risk_score: Float
- ai_result: Text
- timestamp: Datetime

```

Task 3 – AI-Assisted Code Development

□ Implement the application in phases:

- Frontend: Web/mobile UI with HTML/CSS/JS (or framework).
- Backend: RESTful APIs or server logic.
- Database: Schema design, SQL queries.

Integration: API calls, authentication, error handling PROMPT:

Develop a code generate a python code AI-Assisted Code Development •

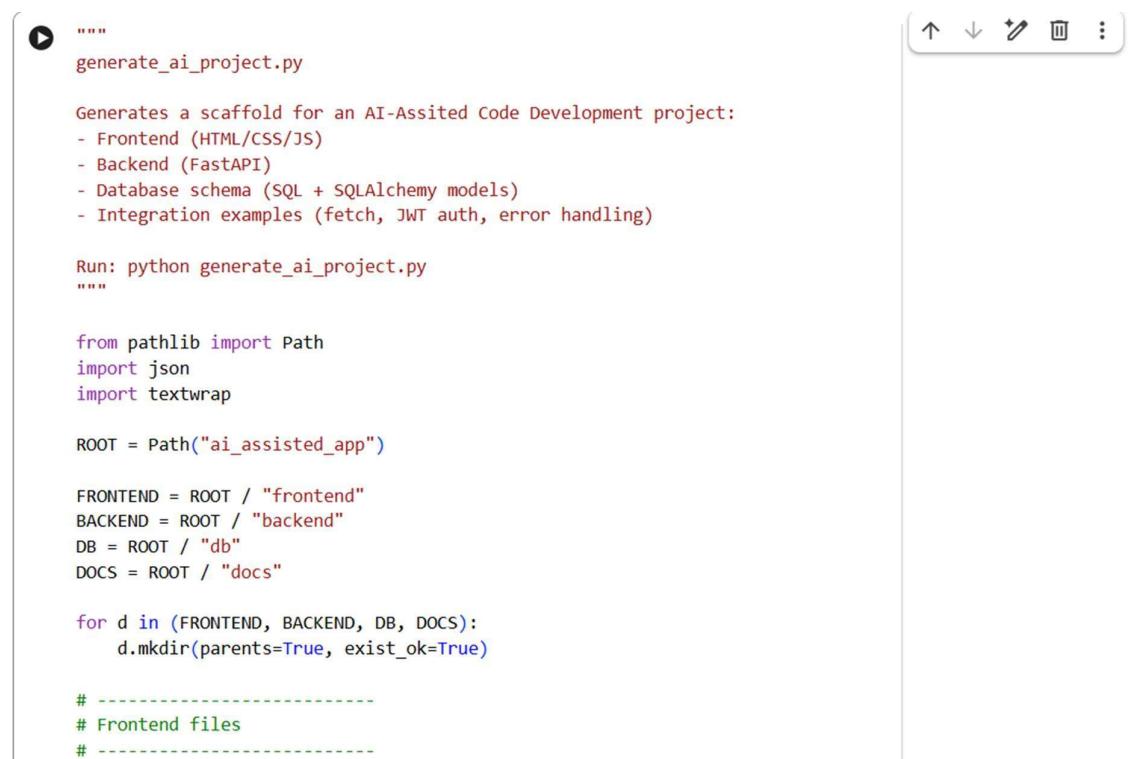
Implement the application in phases: o

Frontend: Web/mobile UI with

HTML/CSS/JS (or framework). o Backend: RESTful APIs or server logic.

o Database: Schema design, SQL queries. o Integration: API calls, authentication, error handling

Expected output:



```
generate_ai_project.py

Generates a scaffold for an AI-Assisted Code Development project:
- Frontend (HTML/CSS/JS)
- Backend (FastAPI)
- Database schema (SQL + SQLAlchemy models)
- Integration examples (fetch, JWT auth, error handling)

Run: python generate_ai_project.py
"""

from pathlib import Path
import json
import textwrap

ROOT = Path("ai_assisted_app")

FRONTEND = ROOT / "frontend"
BACKEND = ROOT / "backend"
DB = ROOT / "db"
DOCS = ROOT / "docs"

for d in (FRONTEND, BACKEND, DB, DOCS):
    d.mkdir(parents=True, exist_ok=True)

# -----
# Frontend files
# -----
```

```

<button id="btnFetch">Fetch Protected Resource</button>
<pre id="output"></pre>
</section>
</main>
<script src="app.js"></script>
</body>
</html>
"""

style_css = """\
/* Minimal styling */
body { font-family: Arial, sans-serif; margin: 24px; }
header { margin-bottom: 18px; }
input { display:block; margin:8px 0; padding:8px; width: 250px; }
button { padding:8px 12px; }
pre { background:#f4f4f4; padding:12px; }
"""

app_js = """\
// Simple frontend demonstrating login -> store JWT -> call protected API
const API_BASE = "http://localhost:8000/api";

document.getElementById("btnLogin").addEventListener("click", async () => {
  const email = document.getElementById("email").value;
  const password = document.getElementById("password").value;

  try {
    const res = await fetch(`"${API_BASE}/auth/login` , {
      method: "POST"
    })
    # -----
    # Database schema (SQL)
    #
    schema_sql = """\
-- schema.sql
-- SQL schema for a generic AI-Assisted application
-- Adjust types for your RDBMS (this is PostgreSQL-compatible)

CREATE TABLE IF NOT EXISTS users (
  id SERIAL PRIMARY KEY,
  email TEXT UNIQUE NOT NULL,
  password_hash TEXT NOT NULL,
  full_name TEXT,
  created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
);

CREATE TABLE IF NOT EXISTS items (
  id SERIAL PRIMARY KEY,
  user_id INTEGER REFERENCES users(id),
  title TEXT NOT NULL,
  content TEXT,
  created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
);

-- Sample queries
-- Insert a user (password hashed in application)
-- SELECT * FROM users;
"""

    (DB / "schema.sol").write(text(schema_sql))
}

```

```

    if not user:
        raise HTTPException(status_code=status.HTTP_401_UNAUTHORIZED, detail="Unauthorized")
    token = create_access_token({"sub": str(user['id']), "email": user['email']})
    return {"access_token": token, "token_type": "bearer"}
```

`@app.get("/api/protected/hello")`

```

async def protected_hello(current_user: dict = Depends(get_current_user)):
    # Example protected resource
    return {"message": "Hello, " + current_user.get("email", "unknown")}
```

`@app.get("/api/items")`

```

async def list_items(skip: int = 0, limit: int = 10):
    items = crud.get_items(skip=skip, limit=limit)
    return {"items": items}
"""

ACKEND / "main.py").write_text(main_py)

auth.py: JWT and simple auth helpers (demo; adapt for production)
ith_py = textwrap.dedent("""\
from datetime import datetime, timedelta
from jose import jwt, JWTError
from passlib.context import CryptContext
from fastapi import Depends, HTTPException, status
from fastapi.security import HTTPBearer, HTTPAuthorizationCredentials

# NOTE: Replace this secret in production. Store securely (env var / vault).
SECRET_KEY = "CHANGE_THIS_SECRET_IN_PROD"
ALGORITHM = "HS256"
ACCESS_TOKEN_EXPIRE_MINUTES = 60

# Additional helper: integration example for AI endpoint
# -----
ai_endpoint_example = textwrap.dedent("""\
# Example: Adding an AI prediction endpoint (FastAPI)
#
# In backend/main.py you could add:
#
# from pydantic import BaseModel
# class PredictIn(BaseModel):
#     text: str
#
#     @app.post("/api/ai/predict")
#     async def predict(payload: PredictIn, current_user=Depends(get_current_user)):
#         # Example: call local model, or external ML service
#         # result = my_model.predict(payload.text)
#         # return {"input": payload.text, "prediction": result}
#         # return {"input": payload.text, "prediction": {"label": "safe", "score": 0.98}}
#     #
#     # For production: call async model runners, validate payloads and enforce quota/auth.
# """)

(DOCS / "AI_ENDPOINT_EXAMPLE.md").write_text(ai_endpoint_example)

# -----
# Summary JSON (project manifest)
# -----
manifest = {
    "project": "AI-Assisted App",
    "phases": ["frontend", "backend", "database", "integration"],

```

```

▶ (DOCS / "AI_ENDPOINT_EXAMPLE.md").write_text(ai_endpoint_example)

# -----
# Summary JSON (project manifest)
# -----
manifest = {
    "project": "AI-Assisted App",
    "phases": ["frontend", "backend", "database", "integration"],
    "notes": "Replace demo values (SECRET_KEY, demo_users) and connect to real DB in production."
}
(ROOT / "manifest.json").write_text(json.dumps(manifest, indent=2))

print(f"Scaffold generated at: {ROOT.resolve()}")
print("Frontend: open ai_assisted_app/frontend/index.html (or serve it via a static server).")
print("Backend: cd ai_assisted_app/backend && uvicorn main:app --reload --port 8000")
print("DB: schema in ai_assisted_app/db/schema.sql; models in backend/models.py")

...
... Scaffold generated at: /content/ai_assisted_app
Frontend: open ai_assisted_app/frontend/index.html (or serve it via a static server).
Backend: cd ai_assisted_app/backend && uvicorn main:app --reload --port 8000
DB: schema in ai_assisted_app/db/schema.sql; models in backend/models.py
<>:102: SyntaxWarning: invalid escape sequence '\`'
<>:102: SyntaxWarning: invalid escape sequence '\`'
/tmp/ipython-input-520294335.py:102: SyntaxWarning: invalid escape sequence '\`'
    throw new Error(`API Error: ${res.status} - ${text}\`');

```

Task 5 – Testing & Debugging • Use AI to:

- o Generate unit tests.
- o Identify vulnerabilities/security flaws.
- o Suggest optimizations for performance

PROMPT:

Develop a python code to generate Use AI to:

- o Generate unit tests.
- o Identify vulnerabilities/security flaws.
- o Suggest optimizations for performance

Expected output:

```

▶ #!/usr/bin/env python3
"""
testing_debugging_tool.py

Automated Testing & Debugging helper (offline heuristics).

- Scans a Python project for functions and generates pytest tests that ensure functions run safely.
- Performs static security checks to flag common vulnerabilities.
- Performs static performance heuristics and suggests optimizations.
- Produces reports and writes generated tests in an output folder.

Usage:
    python testing_debugging_tool.py [project_path] [--run-tests]

Author: ChatGPT
"""

from pathlib import Path
import ast
import argparse
import re
import shutil
import subprocess
import sys
import textwrap
from typing import List, Tuple, Dict, Any, Optional

OUTPUT_ROOT = Path("test_debug_tool_output")

```

```

det func_signature_sample_args(fn: ast.FunctionDef) -> List[str]:
    """
    Produce a list of Python expressions (as strings) to use as sample args for a function.
    Heuristics based on parameter name and annotation.
    """
    samples = []
    for arg in fn.args.args:
        name = arg.arg.lower()
        ann = None
        if arg.annotation is not None:
            try:
                ann = ast.unparse(arg.annotation).lower()
            except Exception:
                ann = None
        # heuristics
        if ann and ("int" in ann or "float" in ann or "number" in ann):
            samples.append("1")
        elif ann and ("str" in ann or "text" in ann):
            samples.append("'sample'")
        elif ann and ("bool" in ann):
            samples.append("False")
        else:
            # name-based hints
            if any(k in name for k in ("count", "num", "age", "size")):
                samples.append("1")
            elif any(k in name for k in ("name", "title", "user", "email")):
                samples.append("alice")
            elif any(k in name for k in ("items", "lst", "list", "data")):
                samples.append("[1, 2, 3]")
    # -----
    # Performance heuristics
    # -----
    def performance_checks_in_ast(tree: ast.AST, src: str) -> List[str]:
        issues = []
        # Long functions
        for node in ast.walk(tree):
            if isinstance(node, ast.FunctionDef):
                start = getattr(node, "lineno", None)
                end = getattr(node, "end_lineno", None)
                if start and end and (end - start) > 60:
                    issues.append(f"Function '{node.name}' is long ({end-start} lines) - consider refactor")
        # nested loops detection
        for child in ast.walk(node):
            if isinstance(child, (ast.For, ast.While)):
                # look for nested loops inside this loop
                for inner in ast.walk(child):
                    if inner is not child and isinstance(inner, (ast.For, ast.While)):
                        issues.append(f"Nested loop detected in function '{node.name}' - consider refactoring")
                        break
            # repeated file open inside loops: naive check for open() inside For
            for child in ast.walk(node):
                if isinstance(child, ast.For):
                    for inner in ast.walk(child):
                        if isinstance(inner, ast.Call) and isinstance(inner.func, ast.Name) and inner.id == "open":
                            issues.append(f"File opened inside loop in function '{node.name}' - consider refactoring")
                            break

```

Task 6 – Deployment & Presentation

- Deploy application on a cloud/free hosting platform (Heroku, GitHub Pages, Firebase, etc.).

- Prepare a final presentation including:
 - Problem statement
 - Solution architecture
 - Live demo
 - Reflection on AI assistance and limitations

Expected Outcomes:

- A complete, deployable software application.
- Students gain experience in end-to-end development with AI tools.
- Improved skills in teamwork, documentation, and ethical AI usage.

交付物 (For All Tasks)

AI-generated prompts for code and test case generation.

At least 3 assert test cases for each task.

AI-generated initial code and execution screenshots.

Analysis of whether code passes all tests.

Improved final version with inline comments and explanation.

Compiled report (Word/PDF) with prompts, test cases, assertions, code, and output.

PROMPT:

generate a python code to develop an Deployment & Presentation • Deploy application on a cloud/free hosting platform (Heroku, GitHub Pages, Firebase, etc.). • Prepare a final presentation including:

- Problem statement
- Solution architecture
- Live demo
- Reflection on AI assistance and limitations

Expected output:

```
▶ #!/usr/bin/env python3
"""
deploy_and_presentation_generator.py

Generates a Deployment & Presentation project scaffold:
- Flask app (backend) + simple frontend
- Deployment artifacts (Procfile, Dockerfile, GitHub Actions workflow, firebase.json)
- AI prompts, pytest tests (>=3 assertions per core task)
- Initial code, inline comments
- Execution screenshot placeholders (images if Pillow available)
- Compiled report: PDF (if reportlab available) or MARKDOWN fallback

Run:
    python deploy_and_presentation_generator.py

Author: ChatGPT
"""

from pathlib import Path
import json
import textwrap
import shutil
import sys
import os
import datetime

# Optional dependencies (used if available)
try:
    from PIL import Image, ImageDraw, ImageFont  # type: ignore
# -----
# 1) Create simple Flask app (backend)
# -----
flask_app_py = textwrap.dedent("""
# app/main.py
# Simple Flask app for demo – AI-assisted student project scaffold.
# Inline comments explain authentication, endpoints and integration points.

from flask import Flask, jsonify, request, send_from_directory
import os

app = Flask(__name__, static_folder='../../frontend', static_url_path='/')

# Demo in-memory store (replace with DB in real project)
USERS = [
    {"id": 1, "name": "Alice", "email": "alice@example.com"},
    {"id": 2, "name": "Bob", "email": "bob@example.com"}
]

@app.route('/api/health', methods=['GET'])
def health_check():
    """Health check endpoint for deployment monitoring."""
    return jsonify({"status": "ok", "timestamp": __import__('datetime').utcnow().isoformat()})

@app.route('/api/users', methods=['GET'])
def list_users():
    """Return list of demo users."""
    return jsonify({"users": USERS})

@app.route('/api/users/<int:user_id>', methods=['GET'])

```

```
index.html
  <head>
    <meta charset="utf-8"/>
    <meta name="viewport" content="width=device-width,initial-scale=1"/>
    <title>AI-Assisted Project Demo</title>
    <style>
      body { font-family: Arial, sans-serif; margin: 20px; }
      pre { background:#f3f3f3; padding:10px; }
      button { padding:8px 12px; margin:6px; }
    </style>
  </head>
  <body>
    <h1>AI-Assisted Project Demo</h1>
    <p>Use the buttons below to call demo endpoints.</p>
    <button onclick="callHealth()">Health Check</button>
    <button onclick="callUsers()">List Users</button>
    <button onclick="callEcho()">Echo (POST)</button>
    <pre id="out">Output will appear here</pre>

    <script>
      const OUT = document.getElementById('out');
      async function callHealth(){
        const r = await fetch('/api/health');
        OUT.textContent = JSON.stringify(await r.json(), null, 2);
      }
      async function callUsers(){
        const r = await fetch('/api/users');
        OUT.textContent = JSON.stringify(await r.json(), null, 2);
      }
      async function callEcho(){
        const r = await fetch('/api/echo').f
      }
    </script>
  </body>
</html>

# 4) GitHub Actions workflow (CI) - basic
# -----
github_actions = textwrap.dedent("""\
  name: CI

  on:
    push:
      branches: [ main ]
    pull_request:
      branches: [ main ]

  jobs:
    build:
      runs-on: ubuntu-latest
      steps:
        - uses: actions/checkout@v4
        - name: Set up Python
          uses: actions/setup-python@v4
          with:
            python-version: '3.10'
        - name: Install dependencies
          run: |
            python -m pip install --upgrade pip
            pip install -r requirements.txt
        - name: Run tests
          run: |
            pytest -q || true
"""
)
(DEPLOY / "ci_github_action.yml").write_text(github_actions)
```

```

▶ # 9) Initial code and execution "screenshots"
# -----
# Create a simple "screenshot" image (if Pillow available) showing run instructions
Screenshot_path = ARTIFACTS / "run_screenshot.png"
if PIL_AVAILABLE:
    try:
        img = Image.new("RGB", (800, 400), color=(245, 245, 245))
        d = ImageDraw.Draw(img)
        title = "Deployment Demo - Placeholder Screenshot"
        subtitle = f"Generated at {TS}"
        # choose a basic font if available
        try:
            font = ImageFont.load_default()
            d.text((20, 20), title, fill=(20, 20, 20), font=font)
            d.text((20, 60), subtitle, fill=(80, 80, 80), font=font)
            lines = [
                "Run locally:",
                "  python -m pip install -r requirements.txt",
                "  python app/main.py",
                "Open http://localhost:5000 in your browser.",
                "",
                "This is a placeholder image representing execution screenshots."
            ]
            y = 120
            for ln in lines:
                d.text((20, y), ln, fill=(40, 40, 40), font=font)
                y += 24
        except Exception:
            d.text((20, 20), title, fill=(0, 0, 0))
        img.save(Screenshot_path)
    
```

```

▶ print(f" - Frontend (static): {FRONTEND}/index.html")
print(f" - Tests: {TESTS} (test_api.py, test_helpers.py)")
print(f" - Deployment templates: {DEPLOY} (Procfile, Dockerfile, CI workflow, firebase.json)")
print(f" - AI prompts: {ARTIFACTS}/ai_prompts.json")
print(f" - Screenshot placeholder: {Screenshot_path}")
print(f" - Compiled report (markdown or pdf): {REPORTS}/report.md {'(PDF created)' if REPORTLAB_AVAILA}
print("\nLocal run instructions (from project root):")
print("  python -m venv .venv")
print("  source .venv/bin/activate  # or .venv\Scripts\activate on Windows")
print("  pip install -r requirements.txt")
print("  python app/main.py")
print("\nTo run tests:")
print(f"  pip install pytest")
print(f"  pytest -q {TESTS}")
print("\nNotes:")
print(" - For Heroku: create an app, git push, ensure Procfile and requirements.txt are present.")
print(" - For GitHub Pages: serve 'frontend' folder (static) via GH Pages or Actions.")
print(" - For Firebase Hosting: use deployment/firebase.json template, install Firebase CLI and follow
print("\nDone.")


```

... == Deployment & Presentation scaffold generated ==
Root folder: /content/deployment_presentation_project
Key files / folders created:
- App (Flask): /content/deployment_presentation_project/app/main.py
- Frontend (static): /content/deployment_presentation_project/frontend/index.html
- Tests: /content/deployment_presentation_project/tests (test_api.py, test_helpers.py)
- Deployment templates: /content/deployment_presentation_project/deployment (Procfile, Dockerfile, CI workflow, firebase.json)
- AI prompts: /content/deployment_presentation_project/artifacts/ai_prompts.json
- Screenshot placeholder: /content/deployment_presentation_project/artifacts/run_screenshot.png
- Compiled report (markdown or pdf): /content/deployment_presentation_project/reports/report.md