Part 1:

a.

Based on the article, we cannot say. You can't really determine if software by itself is safe or unsafe. The article says that "Software safety always depends on the context in which the software is used" which I agree with. Article also says that this is because accidents are often caused by flawed requirements, not implementation errors.

b.

Article says "If we truly want to reduce software-related accidents, we have to focus less on assurance and more on identifying the safety-critical requirements and building safety into these machines from the beginning of development. Safety can't be ensured if it isn't already there; it has to be built in from the beginning." So I guess safety comes into play at the very beginning of software development.

c.

Like a, article says that safety of any software depends on the context in its use, so reusing software isn't automatically safer, and that software that is safe in one context may not be safe in another.

d.

No, object-oriented technology does not inherently lead to safer software. Article says that while oop can be effective for data-oriented systems, its not good for control-oriented systems and can result in software that's difficult to test for safety.

e.

Article says that from a safety perspective, it is better to implement error-handling behavior first rather than normal behavior first. Also says that error-handling is critical for safety and tend to reveal more issues during development.

Part 2:

Use Case Model: Elevator Installation

Use Case 1: Install Elevator

- **Primary Actor(s)**: Elevator Installation Technician
- **Stakeholders**: Project Manager, Building Owner, Supplier
- **Pre-condition(s)**:
    - The elevator shaft and electrical infrastructure are ready.
    - All tools and safety gear are available.
- **Success Guarantee(s)**:
    - The site is safe and prepared for installation.
    - Elevator Components exist and is ready
- **Main Success Scenario**:
    1. Inspect the elevator shaft and surrounding area for safety compliance.
    2. Set up scaffolding and protective measures.
    3. Confirm that the electrical connections meet system requirements.
    4. Unbox and inspect all components.
    5. Install guide rails in the shaft.
    6. Attach counterweights and suspension cables.
    7. Assemble the elevator car.
- **Extensions**:
    - If safety issues are identified, pause and resolve them before proceeding.
    - If any component is defective, replace it before continuing.

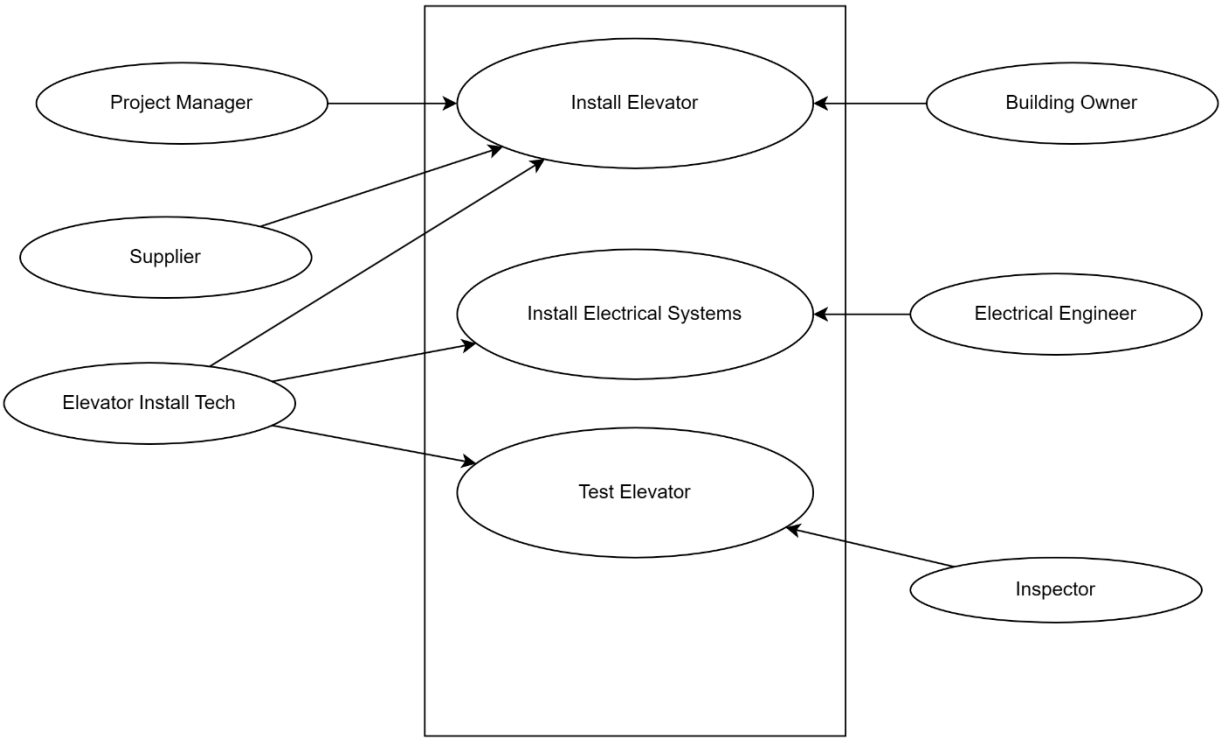
Use Case 2: Install Electrical Systems

- **Primary Actor(s)**: Elevator Installation Technician, Electrical Engineers
- **Stakeholders**: Building Owner, Project Manager
- **Pre-condition(s)**:
    - The building's electrical system is operational.

- **Success Guarantee(s)**:
    - The elevator's electrical system functions correctly.
- **Main Success Scenario**:
    1. Connect the elevator's control system to the building's power supply.
    2. Install sensors and test connections.
    3. Configure the control panel.
- **Extensions**:
    - If power issues arise, work with electrical engineers to resolve them.

Use Case 3: Test and Calibrate Elevator

- **Primary Actor(s)**: Inspector, Elevator Installation Technician
- **Stakeholders**: Building Owner, Project Manager
- **Pre-condition(s)**:
    - The elevator is fully assembled and powered.
- **Success Guarantee(s)**:
    - The elevator meets all safety and performance standards.
- **Main Success Scenario**:
    1. Perform load tests.
    2. Calibrate sensors and controls.
    3. Verify emergency stop and other safety features.
- **Extensions**:
    - If tests fail, troubleshoot and retest before approval.


Project Manager
Supplier
Elevator Install Tech
Install Elevator
Install Electrical Systems
Test Elevator
Building Owner
Electrical Engineer
Inspector

Part 3

Use Case Form for Elevator Control System

Normal Operations

Use Case 1: Request Elevator

- Name: Request Elevator
- Primary Actor(s): Passenger, Control System
- Stakeholders: Building Owner
- Pre-condition(s):
    - Floor buttons are functional.
    - Elevator system is operational.
- Success Guarantee(s):
    - Nearest elevator arrives at the requested floor.
- Main Success Scenario:
    1. Passenger presses the "up" or "down" button on the floor.
    2. Button illuminates and a request is sent to the control system.
    3. The nearest available elevator is dispatched.
    4. Elevator arrives, rings a bell, and opens the doors.
    5. Button light turns off.

Use Case 2: Select Floor

- Name: Select Floor
- Primary Actor(s): Passenger, Control System
- Stakeholders: Building Owner
- Pre-condition(s):
    - Passenger is inside the elevator.
    - Elevator control panel is functional.
- Success Guarantee(s):

    - Elevator moves to the selected floor.

- Main Success Scenario:

    1. Passenger presses the button for the desired floor.
    2. Button illuminates and the elevator starts moving.
    3. Elevator stops at the selected floor, rings a bell, and opens the doors.
    4. Button light turns off.

- Extensions:

    - If an overload is detected, the elevator displays a warning and does not move until resolved.

Use Case 3: Override Door

- Name: Override Door
- Primary Actor(s): Passenger, Control System
- Stakeholders: Building Owner
- Pre-condition(s):

    - Passenger is inside the elevator.
    - The doors are open or closing.

- Success Guarantee(s):

    - Passenger successfully overrides the door timing.

- Main Success Scenario:

    1. Passenger presses the "Open Door" button to hold the door open longer.
    2. Alternatively, passenger presses the "Close Door" button to close the door early.
    3. System adjusts the timing accordingly.

- Extensions:

    - If an obstacle is detected, door remains open regardless of override command.

Safety Operations

Use Case 4: Request Help

- Name: Request Help
- Primary Actor(s): Passenger, Building Safety Service, Emergency Services, Control System
- Stakeholders: Passenger, Building Safety Service
- Pre-condition(s):
    - Elevator is operational.
    - Help button is functional.
- Success Guarantee(s):
    - Passenger is connected to help or emergency services.
- Main Success Scenario:
    1. Passenger presses the "Help" button.
    2. System connects passenger to building safety services through voice.
    3. If no response is received within 5 seconds, a 911 call is initiated.
    4. Passenger receives confirmation and assistance.
- Extensions:
    - If the communication system fails, system displays an error and escalates to an emergency broadcast.

Use Case 5: Detect Door Obstacle

- Name: Detect Door Obstacle
- Primary Actor(s): Control System
- Stakeholders: Passenger
- Pre-condition(s):
    - Elevator doors are closing.
- Success Guarantee(s):

    - Doors reopen and obstacle is addressed.
- Main Success Scenario:
    1. Elevator door sensor detects an obstacle during closing.
    2. Doors stop and reopen.
    3. System retries closing after a brief delay.
    4. If obstruction persists, system issues an audio warning and displays a message.

Use Case 6: Respond to Fire Alarm

- Name: Respond to Fire Alarm
- Primary Actor(s): Control System
- Stakeholders: Passengers, Building Safety Service
- Pre-condition(s):
    - Fire alarm is active in the building or elevator.
- Success Guarantee(s):
    - Elevators move to a safe floor and passengers disembark.
- Main Success Scenario:
    1. Fire alarm signal is received by the control system.
    2. System halts all new requests and overrides current operations.
    3. All elevators move to the designated safe floor.
    4. System issues emergency instructions via audio and display.

Use Case 7: Handle Overloaded Cart

- Name: Handle Overloaded Cart
- Primary Actor(s): Control System
- Stakeholders: Passenger

- Pre-condition(s):
    - Elevator is operational, and passengers are boarding.
- Success Guarantee(s):
    - Overload is resolved before operation continues.
- Main Success Scenario:
    1. Overload is detected by the elevator control system sensor.
    2. System prevents elevator movement.
    3. Audio and text warnings request reduction of load.
    4. Once resolved, elevator resumes normal operation.
- Extensions:
    - If overload is not resolved, system escalates to building management.

Use Case 8: Respond to Power Outage

- Name: Respond to Power Outage
- Primary Actor(s): Control System
- Stakeholders: Passengers, Building Owner
- Pre-condition(s):
    - Power outage occurs in the building.
- Success Guarantee(s):
    - Elevators are moved to a safe floor using backup power, and passengers disembark.
- Main Success Scenario:
    1. System detects power outage and switches to backup power.
    2. All elevators move to safe floors.
    3. Audio and text warnings instruct passengers to disembark.
    4. Elevators remain out of service until power is restored.

- Extensions:
    - If backup power fails, system alerts building management.