Republic of the Philippines
Laguna State Polytechnic University
Province of Laguna

Exercise No. 3			
Topic:	**Module 2.0: Probabilistic Reasoning in AI**	**Week No.**	5-6
Course Code:	**CSST101**	**Term:**	1st Semester
Course Title:	**Advance Representation and Reasoning**	**Academic Year:**	2024-2025
Student Name		**Section**	
Due date		**Points**	

Instructions:

Complete the following tasks by hand. Show all calculations and explanations where applicable.

Part 1: Defining the Problem and System Design

1. **Select a Disease for Diagnosis**
   Choose a disease that your AI system will predict (e.g., diabetes, heart disease, or a viral infection).

   - **Question:** What disease did you choose, and what factors (symptoms, test results) contribute to diagnosing this disease?

     Answer:

     Disease: _____
     Contributing Factors: _____

Part 2: Basic Probability Calculations

2. **Bayesian Inference Calculation**

   Imagine that a patient has undergone a diagnostic test for the disease. Use the following information:

   - Prior probability (prevalence of the disease): $P(Disease) = 0.02$
   - Test sensitivity (probability of a positive result given disease): $P(Positive|Disease) = 0.95$
   - False positive rate (probability of a positive result given no disease): $P(Positive|NoDisease) = 0.05$
   - Probability of a positive result in the population: $P(Positive) = 0.06$
   - **Task:** Calculate the **posterior probability** that the patient has the disease given that they tested positive.

   Formula (Bayes' Theorem):

$$P(Disease|Positive) = \frac{P(Positive|Disease) \times P(Disease)}{P(Positive)}$$

   - **Answer:**

Posterior Probability: _____

Part 3: Decision-Making Simulation

3. **Simulate a Decision with Uncertain Outcomes**
   Suppose a doctor must decide whether to treat a patient based on test results. Treatment has a 70% chance of success and provides a benefit of 100 points to the patient's health, but it also carries a 30% risk of failure, leading to a 50-point reduction.

   - **Task:** Calculate the **expected health improvement** for the patient based on these probabilities.

   Formula:

   $$\text{Expected Health Improvement} = P(Success) \times Benefit + P(Failure) \times Loss$$

   - **Answer:**

   Expected Improvement: _____

Part 4: Visualize a Probability Distribution

4. **Visualize a Binomial Distribution**
   Consider a scenario where you flip a coin 5 times, where each flip has a 50% chance of landing heads.

   - **Task:** Draw a probability distribution showing the chances of getting 0 to 5 heads.

Reflection Question:

5. **Reflection:**

   In 3-4 sentences, explain how understanding probability theory helps in making decisions in medical diagnosis systems.

   Answer:

Rubric: Handwritten Exercise - AI-Powered Medical Diagnosis System

Criteria	Excellent (10 points)	Good (8 points)	Fair (5 points)	Poor (2 points)
Problem Definition and System Design	Clear selection of disease, with detailed and accurate description of contributing factors.	Disease selection is clear, but contributing factors lack detail or are incomplete.	Disease is selected, but contributing factors are vague or unclear.	No disease selected, or missing contributing factors.
Bayesian Inference Calculation	Correct calculation using Bayes' Theorem with all steps shown clearly.	Calculation mostly correct, with minor mistakes or missing steps.	Significant errors in calculation or steps not clearly explained.	Incorrect or incomplete calculation, no explanation.
Decision-Making Simulation	Correct expected improvement calculation with clear steps and explanation.	Calculation mostly correct, with minor errors or unclear explanation.	Some attempt at calculating expected improvement, but steps are unclear or incorrect.	No attempt to calculate expected improvement or incorrect without explanation.
Visualization of Probability Distribution (Bonus)	Correct and clearly drawn binomial distribution, showing probabilities for each outcome.	Mostly correct distribution, with some inaccuracies or missing details.	Attempt at drawing the distribution, but contains major inaccuracies or missing parts.	No attempt or severely incorrect distribution.
Reflection Question	Thoughtful and accurate explanation of how probability theory aids in decision-making, with clear examples.	Clear explanation of the role of probability theory, but lacks depth or examples.	Basic explanation with little detail, missing how probability directly impacts decision-making.	Reflection missing or very unclear.
Neatness and Clarity of Work	Work is very neat, well-organized, and easy to read.	Work is mostly neat and readable, with only minor disorganization.	Work is somewhat disorganized or difficult to read.	Work is very disorganized or unreadable.