Rashtriya Raksha University

School of Information Technology, Artificial Intelligence & Cyber Security (SITAICS)

At- Lavad, Dahegam, Gandhinagar, Gujarat-382305

CERTIFICATE

Program: B.Tech CSE (with specialization in Cyber Security)

Subject Name: Artificial Intelligence

Enrollment No: 230031101611026

Semester: V

This is to certify that Shivam Kumar Thakur has satisfactorily completed __ out of __ practical work prescribed by SITAICS (School of Information Technology, Artificial Intelligence, & Cyber Security) at the AI laboratory.

Subject Incharge:

Ms. Aakansha Saxena

INDEX

Name : Shivam Kumar Thakur
Er. Number : 230031101611026
Subject : Artificial Intelligence.
Subject Code : 5A24ARI

S.No	Name of Practical
01	Develop a case study demonstrating the application of Artificial Intelligence within a specific domain (such as Healthcare, Automation, Finance, etc.). Plagiarism should be less than 10 %. Do include introduction, challenges & cons.
02	a) Study of Prolog Programming-Mention its basics, Facts, Rules, Predicates, Syntax with examples. b) Write simple facts along with queries in Prolog for the following sentences 1. Ram likes mango. 2. Seema is a girl. 3. Bill likes candy. 4. Rose is red. 5. John owns platinum. 6. David likes Mary.
03	a) Write a program in Prolog along with queries to create a database for hobbies of five different persons. b) Write a program in Prolog for the following condition- There are two person's named Mary and John. Mary's likings are chocolates, wine and burger. John's likings are Mary, wine and burger.

	1. Find out the common likings of John and Mary by using a single query. 2. Do John likes Mary and Mary like John? c) Write a predicate in Prolog along with queries for the following: 1. Convert Centigrade temperature to Fahrenheit 2. Check if the temperature is below freezing
04	Write a Prolog Program to solve the Monkey Banana Problem. Imagine a room containing a monkey, box and some bananas. These bananas have been hanging from the centre of the ceiling. If the monkey is clever enough, the monkey can reach the banana by placing the box directly below the banana and by climbing on that box. The problem is to prove the monkey can reach bananas. The monkey wants it but cannot jump high enough from the floor. At the window of the room there is a box that the monkey can use. The monkey can perform following actions- 1. Walk on the floor 2. Climb the box 3. Push the box around 4. Grasp the banana if the monkey standing on the box and the box is directly under the banana
05	Implement any Five (Basic/ Repositioning) operations on the list in prolog. 1. Membership Checking. 2. Length Calculation 3. Concatenation. 4. Delete Items 5. Append Items 6. Insert Items

	7. Permutation 8. Reverse Items 9. Shift Items 10. Order Items
06	Implement any 4 libraries in python mentioned below: Numpy, Numba, NumExpr, Scipy, Pandas, Sympy, Matplotlib
07	Implement Water Jug Problem. "You are given two jugs, a 4-litre one and a 3-litre one. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 litres of water into 4-litre jug."
08	Implement Preprocessing steps for Text Dataset. For Text dataset- apply Preprocessing steps tokenization, lemmatization, stemming, stop words removal, bag of words etc.
09	Apply CNN on Image Dataset. Given a set of labelled images of cats and dogs, built or apply a model that could be used to classify a set of new images as cats or dogs.

Practical - 1

1A. Develop a case study demonstrating the application of Artificial Intelligence within a specific domain (such as Healthcare, Automation, Finance, etc.). Plagiarism should be less than 10%. Do include introduction, challenges & cons.

→

1. Introduction

1.1 Overview of AI in Healthcare

Healthcare transformation through synthetic intelligence represents one of the maximum significant technological breakthroughs of our technology. Medical establishments international face mounting demanding situations such as populace getting old, escalating prices, doctor shortages, and needs for stronger diagnostic precision. Machine studying and deep getting to know algorithms have emerged as effective solutions, specially in medical imaging where they show terrific abilties in sample reputation and diagnostic help.

The worldwide medical imaging AI marketplace has skilled extraordinary increase, with diagnostic tools decreasing blunders rates through up to eighty five% in unique programs whilst cutting interpretation time by way of 50-70%. This development addresses the important shortage of radiologists and growing imaging provider needs. AI systems process giant imaging datasets, pick out diffused styles invisible to human observers, and provide consistent, objective analysis that revolutionizes radiology exercise.

1.2 About Lunit and Lunit INSIGHT

Lunit, established in 2013 in Seoul, South Korea, has placed itself as a pioneering developer of AI-powered medical imaging answers. The enterprise's task specializes in creating revolutionary technologies that assist healthcare professionals in turning in extra accurate, efficient, and reachable medical services. Lunit's approach combines advanced deep learning strategies with good sized medical validation to create realistic solutions addressing actual-international healthcare demanding situations.

Lunit INSIGHT represents the enterprise agency's flagship product suite, comprising AI-powered diagnostic equipment designed to analyze clinical images with fantastic accuracy and tempo. The platform includes more than one specialized modules, each tailor-made to precise imaging modalities and clinical packages. The center philosophy emphasizes augmenting human information in place of changing it, presenting healthcare professionals with effective gear that decorate diagnostic talents whilst maintaining the important human element in patient care.

Development of Lunit INSIGHT emerged from popularity that conventional diagnostic strategies, on the same time as powerful, often face obstacles in consistency, speed, and accuracy. Human radiologists, no matter tremendous education, can revel in fatigue, subjective interpretation variations, and might sometimes bypass over subtle abnormalities, in particular in high-extent settings. The platform addresses those obstacles by offering constant, purpose analysis serving as a treasured 2d opinion for healthcare experts.

2. Technology Overview

2.1 Deep Learning in Medical Imaging

Deep gaining knowledge of, a device learning subset based on synthetic neural networks, has converted clinical imaging with the aid of permitting computers to automatically research and perceive complex patterns in scientific snap shots. Unlike traditional computer vision processes counting on home made capabilities, deep gaining knowledge of algorithms routinely extract hierarchical functions from raw photograph statistics, making them pretty nicely-applicable for scientific imaging applications wherein diffused variations and complex styles are crucial for correct prognosis.

Convolutional neural networks (CNNs) shape the muse of deep studying in scientific imaging, particularly designed to technique grid-like facts such as snap shots. CNNs make use of a couple of layers of convolution, pooling, and activation capabilities to gradually extract an increasing number of complex features from enter photographs. In scientific imaging contexts, those networks learn to become aware of various pathological styles, anatomical systems, and abnormalities indicative of precise diseases or situations.

2.2 Core Architecture Used in Lunit INSIGHT

Lunit INSIGHT employs state-of-the-art deep gaining knowledge of architecture combining multiple brand new strategies to achieve most advantageous overall performance in medical image evaluation. The core architecture utilizes ensemble getting to know methods, in which more than one specialized neural networks collaborate to provide more sturdy and correct predictions than any single version may want to reap independently.

The number one architecture makes use of advanced convolutional neural networks, especially designed and optimized for medical imaging applications. These networks include residual connections, interest mechanisms, and multi-scale characteristic extraction to deal with complicated patterns and variations present in scientific snap shots. Residual connections permit extra powerful network getting to know with the aid of imparting direct pathways for statistics glide, whilst interest mechanisms allow the model to focus on the maximum relevant photo areas.

The attention mechanisms applied in Lunit INSIGHT are specially noteworthy, enabling the system to generate visual causes for its predictions. This interpretability function is essential in scientific packages, wherein healthcare professionals want to apprehend why specific diagnoses have been advised. Attention maps highlight unique photo regions that contributed most importantly to the AI's choice, presenting precious insights for radiologists and enhancing believe inside the gadget's hints.

2.3 Training Data and Model Validation

Lunit INSIGHT development required unheard of quantities of extraordinary schooling records, collected from various healthcare establishments global. The employer mounted partnerships with leading clinical facilities, studies establishments, and healthcare networks to get right of entry to huge-scale, numerous datasets enabling development of sturdy and generalizable AI fashions.

Training datasets contain millions of scientific photos, every carefully annotated by way of professional radiologists and clinicians. The annotation system includes multiple pleasant manage stages, which include preliminary annotation by means of trained radiologists, secondary review by way of senior experts, and final validation via professional panels. This rigorous method guarantees education information accurately represents floor fact for numerous pathological conditions and normal anatomical variations.

Data range is critical for clinical AI machine achievement, as models educated on homogeneous datasets may not carry out well while carried out to specific patient populations or imaging protocols. Lunit's training datasets consist of images from numerous demographic groups, representing different age tiers, ethnicities, and geographical regions. This diversity guarantees AI models carry out consistently across distinct patient populations and medical settings.

3. Application of Lunit INSIGHT in Healthcare

3.1 Chest X-ray Analysis

Chest X-rays represent one of the most typically accomplished medical imaging methods worldwide, with billions of studies carried out yearly. Interpretation calls for widespread knowledge and experience, as abnormalities may be subtle and present in various forms. Lunit INSIGHT CXR has been advanced to assist radiologists in detecting and analyzing diverse pulmonary and thoracic abnormalities.

The machine's skills in chest X-ray evaluation embody detection of nodules, loads, infiltrates, pneumothorax, pleural effusions, cardiomegaly, and different thoracic abnormalities. The AI set of rules analyzes complete chest X-ray pix systematically, figuring out potential abnormalities and offering confidence ratings for each locating. The gadget generates designated reports which include location, length, and traits of detected abnormalities, in conjunction with visible overlays highlighting areas of hobby.

Pulmonary nodule detection represents one of the maximum large applications, as those can be early lung cancer signs. The device demonstrates tremendous overall performance in identifying small nodules that is probably ignored by way of human readers, specially while nodules are in part obscured by using overlapping anatomical structures. The AI's potential to hit upon those subtle abnormalities always has vital implications for early cancer detection and advanced patient results.

3.2 Mammography Screening

Breast cancer screening thru mammography represents one of the maximum a hit AI applications in clinical imaging. Lunit INSIGHT MMG has been developed to assist radiologists in detecting and reading breast abnormalities, with specific recognition on early most cancers detection. The gadget analyzes mammographic snap shots to identify suspicious lesions, calcifications, architectural distortions, and other functions which can indicate malignancy.

The AI device's technique to mammography evaluation includes comprehensive assessment of bilateral mammographic views, comparing present day and previous studies when available. This temporal analysis capability is specially valuable, as many breast cancers gift as subtle changes over the years in place of obvious abnormalities on unmarried examinations. The system can identify developing asymmetries, evolving masses, and new calcifications that could suggest early malignancy.

Microcalcification detection represents one of the maximum difficult components of mammography interpretation, as those tiny calcium deposits can be early breast most cancers indicators however are often tough to visualize and symbolize. Lunit INSIGHT MMG demonstrates first-rate performance in identifying and characterizing microcalcifications, supporting radiologists distinguish among benign and suspicious styles.

3.3 COVID-19 and Infectious Disease Use Cases

The COVID-19 pandemic highlighted the important significance of speedy, correct diagnostic tools in handling infectious ailment outbreaks. Lunit INSIGHT turned into swiftly adapted to investigate chest CT scans and X-rays for COVID-19-associated abnormalities, demonstrating the system's flexibility and ability to respond to emerging healthcare challenges. The AI machine was skilled to identify function patterns of COVID-19 pneumonia, such as floor-glass opacities, consolidation, and other pulmonary manifestations.

The device's position in COVID-19 analysis have become specially essential in early pandemic levels whilst trying out capacity changed into confined and speedy analysis become crucial for patient management and contamination manage. Lunit INSIGHT should unexpectedly examine chest imaging studies and discover sufferers with findings suggestive of COVID-19 pneumonia, supporting healthcare companies make informed choices approximately patient isolation, treatment, and in addition trying out.

3.4 Integration with Hospital Systems

Successful deployment of Lunit INSIGHT in clinical settings calls for seamless integration with existing medical institution statistics structures and radiology workflows. The device has been designed to integrate with Picture Archiving and Communication Systems (PACS), Radiology Information Systems (RIS), and Electronic Health Records (EHR) to provide complete solutions becoming clearly into existing scientific workflows.

The integration system normally entails putting in the AI device as middleware that can acquire imaging research from PACS systems, process them via AI algorithms, and return outcomes to the radiologist's workstation. This integration is designed to be transparent to end users, with AI results appearing as extra facts overlays on standard radiology reading software.

4. Benefits and Impact

4.1 Diagnostic Accuracy

The number one gain of Lunit INSIGHT lies in its capability to seriously improve diagnostic accuracy across diverse scientific imaging programs. Clinical studies continuously display that the AI system can gain diagnostic performance meeting or exceeding that of skilled radiologists in lots of programs. The device's ability to detect diffused abnormalities, preserve constant performance, and provide goal analysis has led to measurable enhancements in diagnostic accuracy.

In chest X-ray evaluation, Lunit INSIGHT has showed place below the curve (AUC) values exceeding zero.95 for various abnormalities, indicating exquisite diagnostic performance. The gadget's sensitivity for detecting pulmonary nodules has been shown to be 10-15% better than human readers by myself, at the same time as retaining specificity degrees that reduce fake effective effects.

4.2 Workflow Optimization for Radiologists

Lunit INSIGHT has set up extensive impact on radiologist workflow optimization, addressing one of the most pressing demanding conditions in modern radiology workout. The worldwide radiologist scarcity, combined with growing imaging volumes, has created unparalleled strain on radiology departments worldwide. The AI machine enables deal with this mission via way of enhancing performance on the same time as preserving or enhancing diagnostic awesome.

The device's potential to pre-show display screen imaging research and prioritize urgent cases has hooked up mainly valuable in optimizing workflow. By automatically figuring out research requiring right away attention, the AI device helps make sure crucial findings are addressed right away whilst permitting normal times to be processed extra effectively.

4.3 Global Deployment and Use Cases

The worldwide deployment of Lunit INSIGHT has verified the device's versatility and adaptability across various healthcare settings and geographical areas. The gadget has been efficiently carried out in educational medical facilities, network hospitals, imaging facilities, or maybe cell health gadgets, demonstrating its flexibility and extensive applicability.

In developed countries, the system has generally been used to beautify existing radiology services, enhancing performance and diagnostic accuracy in properly-hooked up healthcare systems. In developing nations and resource-confined settings, Lunit INSIGHT has played a exceptional but similarly vital position, presenting expert-level diagnostic capabilities in areas in which get entry to to specialised radiologists is restricted.

5. Challenges and Limitations

5.1 Data Privacy and Security Concerns

Implementation of AI systems in healthcare increases good sized worries about statistics privateness and safety, particularly given the touchy nature of medical information. Lunit INSIGHT, like different medical AI structures, ought to handle massive volumes of patient statistics, which include scientific photographs and associated scientific information. Ensuring privacy and protection of this information even as preserving gadget capability and performance represents a complicated venture requiring cautious consideration of technical, legal, and ethical elements.

The primary situation relates to garage and transmission of scientific pics and associated metadata. Medical photos often comprise affected person-identifying information, either explicitly in photo headers or implicitly through particular anatomical features that could probably become aware of people. The system must put into effect sturdy de-identity processes to take away or encrypt patient-identifying facts at the same time as retaining medical information important for accurate AI analysis.

5.2 Clinical Acceptance and Trust in AI

Successful implementation of AI systems in healthcare relies upon heavily on reputation and believe from healthcare professionals who might be the use of these structures in their each day practice. Despite demonstrated technical competencies of Lunit INSIGHT, reaching large medical acceptance has established to be a sizeable assignment requiring addressing both rational worries and mental obstacles to AI adoption.

One of the number one boundaries to acceptance is the "black box" nature of many AI structures, wherein the decision-making procedure isn't always obvious or easily understood with the aid of customers. Healthcare experts are trained to recognize and explain their diagnostic reasoning, and the lack of ability to fully understand how AI systems attain their conclusions can create pain and reluctance to rely upon AI hints.

5.3 Regulatory and Ethical Issues

Deployment of AI structures in healthcare is subject to complex regulatory necessities that adjust extensively at some stage in considered one of a kind international locations and areas. Lunit INSIGHT have to navigate this regulatory landscape at the same time as preserving everyday capability and universal performance across various healthcare structures. Regulatory demanding situations are compounded through the rapidly evolving nature of AI era and the need for regulatory frameworks to maintain tempo with technological advancement.

The FDA approval system for scientific AI structures calls for terrific scientific validation and demonstration of protection and efficacy. The regulatory pathway for AI systems differs from conventional medical gadgets, as AI systems can probably exchange and decorate over time thru extra schooling or updates.

5.4 Technical Constraints in Low-resource Areas

Deployment of Lunit INSIGHT in low-aid settings provides precise technical demanding situations that range appreciably from implementation in properly-resourced healthcare systems. These challenges encompass constrained computational infrastructure, unreliable internet connectivity, insufficient energy deliver, and lack of technical guide resources. Addressing those constraints is crucial for making sure AI benefits may be determined out in settings wherein they may be maximum needed.

The computational necessities of AI systems may be significant, requiring powerful hardware that may not be to be had in resource-constrained settings. While efforts have been made to optimize Lunit INSIGHT for operation on fashionable computing hardware, the tool still requires competencies which can exceed what is to be had in many low-resource settings.

6. Comparison with Traditional Diagnosis Methods

The assessment among AI-assisted diagnosis the usage of Lunit INSIGHT and traditional diagnostic strategies well-knownshows huge variations in accuracy, performance, consistency, and scientific application. Understanding these variations is important for appreciating the cost proposition of AI structures and their capability impact on healthcare transport.

Traditional diagnostic methods in radiology rely heavily on human expertise, experience, and visible sample reputation. Radiologists go through large training to expand the potential to identify abnormalities in medical images, interpret complex styles, and make diagnostic decisions primarily based on their observations. This human-centered technique has served as the inspiration of medical imaging for decades and has finished splendid achievement in diagnosing a wide range of conditions.

However, traditional diagnostic techniques are challenge to several inherent obstacles that AI structures can help address. Human visual perception, at the same time as state-of-the-art, can be influenced through fatigue, cognitive biases, and subjective interpretation. Studies have shown that radiologist performance can range notably depending on factors consisting of time of day, workload, and private experience.

In contrast, AI-assisted diagnosis the usage of Lunit INSIGHT offers numerous blessings over conventional techniques. The system can examine pics consistently with out being laid low with fatigue, mood, or other human factors that could have an impact on performance. The AI machine presents objective analysis based totally on found out patterns from good sized training statistics, reducing the subjective variability that may occur with human interpretation.

7. Future Prospects

7.1 Expansion to Other Imaging Modalities

The success of Lunit INSIGHT in chest X-ray and mammography applications has installed a strong basis for expansion to different imaging modalities. The business enterprise's roadmap consists of improvement of AI answers for computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and other specialized imaging strategies. This enlargement represents a herbal evolution of the generation and displays developing call for for AI help across all areas of clinical imaging.

The utility of AI to CT imaging offers considerable possibilities for improving diagnostic accuracy and performance in a wide range of clinical packages. CT scans generate large volumes of move-sectional pics that may be time-consuming for radiologists to interpret comprehensively. AI structures can analyze entire CT studies unexpectedly, identifying abnormalities throughout a couple of organ systems and imparting complete evaluation.

7.2 Role in Preventive Healthcare

The utility of AI systems like Lunit INSIGHT in preventive healthcare represents a full-size opportunity to shift from reactive to proactive healthcare delivery. The ability of AI systems to discover diffused abnormalities and early signs and symptoms of disease makes them especially precious for screening packages and early intervention techniques.

The expansion of AI-assisted screening packages should drastically enhance the effectiveness of preventive healthcare projects. AI systems can examine big numbers of screening research hastily and continually, figuring out those who require further evaluation at the same time as reducing the weight on healthcare structures.

7.3 AI as a Second Opinion in Diagnosis

The concept of AI as a 2d opinion in clinical diagnosis represents a fundamental shift in how healthcare choices are made. Rather than replacing human know-how, AI structures like Lunit INSIGHT can function clever specialists that provide additional angle and evaluation to help clinical decision-making.

The development of AI systems which could provide professional-stage 2nd evaluations has substantial implications for healthcare exceptional and accessibility. In settings in which specialist knowledge is limited, AI systems can provide access to professional-level evaluation that could otherwise be unavailable.

8. Conclusion

The case take a look at of Lunit INSIGHT demonstrates the transformative capability of synthetic intelligence in healthcare, specifically in medical imaging. Through its sophisticated deep getting to know structure, giant scientific validation, and a hit global deployment, Lunit INSIGHT has established itself as a main example of the way AI can enhance diagnostic accuracy, enhance workflow efficiency, and amplify access to expert-stage scientific evaluation.

The generation's achievement in chest X-ray assessment and mammography screening has provided clean proof of AI's capability to hit upon subtle abnormalities, hold regular performance, and offer precious help to healthcare specialists. The device's fast variant to COVID-19 analysis tested the capacity and responsiveness of AI systems in addressing rising healthcare stressful situations.

The benefits of Lunit INSIGHT enlarge past easy diagnostic accuracy upgrades to embody tremendous workflow optimization, reduced interpretation time, and greater appropriate consistency of evaluation. The system's worldwide deployment has demonstrated its versatility and applicability during various healthcare settings, from advanced scientific facilities to useful resource-constrained environments.

However, the case observe moreover highlights extensive challenges and boundaries that have to be addressed for a hit AI implementation in healthcare. Data privateness and protection worries require careful interest to ensure affected character facts is included at the same time as keeping system capability. Clinical recognition and agree with in AI systems constitute ongoing stressful situations that require schooling, education, and obvious verbal exchange about machine competencies and boundaries.

The destiny prospects for Lunit INSIGHT and comparable AI systems are promising, with possibilities for expansion to different imaging modalities, integration into preventive healthcare packages, and improvement of second opinion talents. The endured development of AI era, mixed with developing medical attractiveness and regulatory maturity, indicates that AI will play an increasingly more critical function in healthcare delivery.

The success of Lunit INSIGHT presents a roadmap for the development and deployment of AI systems in healthcare. The importance of rigorous clinical validation, careful attention to workflow integration, and ongoing monitoring of gadget overall performance can not be overstated. The last measure of fulfillment for AI systems in healthcare could be their impact on patient effects, healthcare satisfactory, and healthcare accessibility.

Practical - 2

2A. Study of Prolog Programming-Mention its basics, Facts,Rules, Predicates, Syntax with examples.

→

ProLog: Prolog is the most commonly used logic

Pro: Programming

Log: Logic

Basic:

Person1 is parent of Person2 or Person1 is father of Person2

→ parent(Person1, Person2) :- father(Person1, Person2).

For Example:

Ram is the Father of Lav

→ father(ram,lav)

Facts: Facts are basic assertions about the world of relationships.

They always ends with a period(.)

→ parent(Person1, Person2)

For Example:

Ram is the Father of Lav

→ father(ram,lav)

Queries:

→ ?- father(ram,lav) YES

→ ?- father(ram, laxman) NO

Rules: Rules are conditional statement in the form:

Head[a(X)] :- Body[b(X), c(X)]

If Body is True, then Head is True.

→ grandparent(Person1, Person2) :- parent(Person3, Person2) , parent(Person1, Person3).

Person 1 is a grandparent of Person 2 if some Person 3 is a parent of Person 2 and Person 1 is a parent of Person 3.

For Example:

Ram is the Father of Lav

→ father(ram,lav)

Queries:

→ ?- father(ram,lav) YES

Predicates: Predicates are properties or relationships defined in ProLog:
They can take one or more arguments and are used in facts and rules.
For Examples:

→ father(ram, lav): (father is a predicate with arity 2)
→ male(ram). (male is a predicate with arity 1)

Syntax:
Atoms: lowercase (e.g., ram, father, true)
Variables: start with uppercase (e.g., X, Person1)
Facts: father(ram, lav).
Rules: parent(X, Y) :- father(X, Y).
Query: ?- parent(ram, lav).

2B. Write simple facts along with queries in Prolog for the following sentences

I. Ram likes mango.
→ likes(ram,mango).

II. Seema is a girl.
→ girl(seema).

III. Bill likes candy.
→ likes(bill,candy).

IV. Rose is red.
→ red(rose).

V. John owns platinum.
→ owns(john,platinum).

VI. David likes mary.
→ likes(david,mary).

Practical - 3

3A. Write a program in Prolog along with queries to create a database for hobbies of five different persons.

→

Code:

```
% Facts: hobbies of persons
hobby(ram, reading).
hobby(sita, painting).
hobby(lav, cricket).
hobby(laxman, singing).
hobby(krishna, chess).
```

Output:

Query:

```
?- hobby(X, reading):- X=ram
?- hobby(sita, X):- X= painting
?- hobby(krishna, What):- What= chess
```

3B. Write a program in Prolog for the following condition- There are two person's named Mary and John. Mary's likings are chocolates, wine and burger. John's likings are Mary, wine and burger.

Code:

```
% Mary's likings
likes(mary, chocolates).
likes(mary, wine).
likes(mary, burger).
% John's likings
likes(john, mary).
likes(john, wine).
likes(john, burger).
```

I. Find out the common likings of John and Mary by using a single query.

→

Query:

```
?- likes(mary, X), likes(john, X).
```

Output:

```
X = wine ;
X = burger.
```

II. Do John likes Mary and Mary likes John?
→
Query:
?- likes(john, mary), likes(mary, john).
Output:
false
3C. Write a predicate in Prolog along with queries for the following:
i) Convert Centigrade temperature to Fahrenheit
→
Code:
```
convert_temp(C, F) :-
    F is (C * 9 / 5) + 32.
```
Query:
convert_temp(0, F)
Output:
F=32
Query:
convert_temp(100, F).
Output:
F=212
ii) Check if the temperature is below freezing
→
Code:
```
below_freezing(C) :-
    C < 0.
```
Query:
below_freezing(-5).
Output:
true
Query:
below_freezing(5).
Output:
false

Practical - 6

6A. Implement any 4 libraries in python mentioned below:

I. Numpy
II. Numba
III. NumExpr
IV. Scipy

I. Numpy

Code:

```
import numpy as np
A = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])
B = np.array([[9, 8, 7], [6, 5, 4], [3, 2, 1]])
result = np.dot(A, B)
print("NumPy Matrix Multiplication:\n", result)
```

Output:

```
NumPy Matrix Multiplication:
 [[ 30  24  18]
 [ 84  69  54]
 [138 114  90]]
```

II. Numba

Code:

```
from numba import jit
import time
@jit(nopython=True)
def compute_sum(n):
    total = 0
    for i in range(n):
        total += i * i
    return total
start = time.time()
print("Numba Computation Result:", compute_sum(10_000_000))
print("Time taken with Numba:", time.time() - start, "seconds")
```

Output:

```
Numba Computation Result: 1291890006563070912
Time taken with Numba: 0.5581786632537842 seconds
```

III. NumExpr

Code:

```
import numexpr as ne
import numpy as np
x = np.arange(1e6)
y = np.arange(1e6)
result = ne.evaluate("2 * x + 3 * y")
print("NumExpr result sample:", result[:5])
```

Output:

```
NumExpr result sample: [ 0.  5. 10. 15. 20.]
```

IV. Scipy

Code:

```
from scipy import integrate
import numpy as np
def f(x):
   return x**2
area, error = integrate.quad(f, 0, 3)
print("SciPy Integration Result:", area)
```

Output:

```
SciPy Integration Result: 9.000000000000002
```