Assignment 6

Experiment 12:

Title: Study of ANN Models

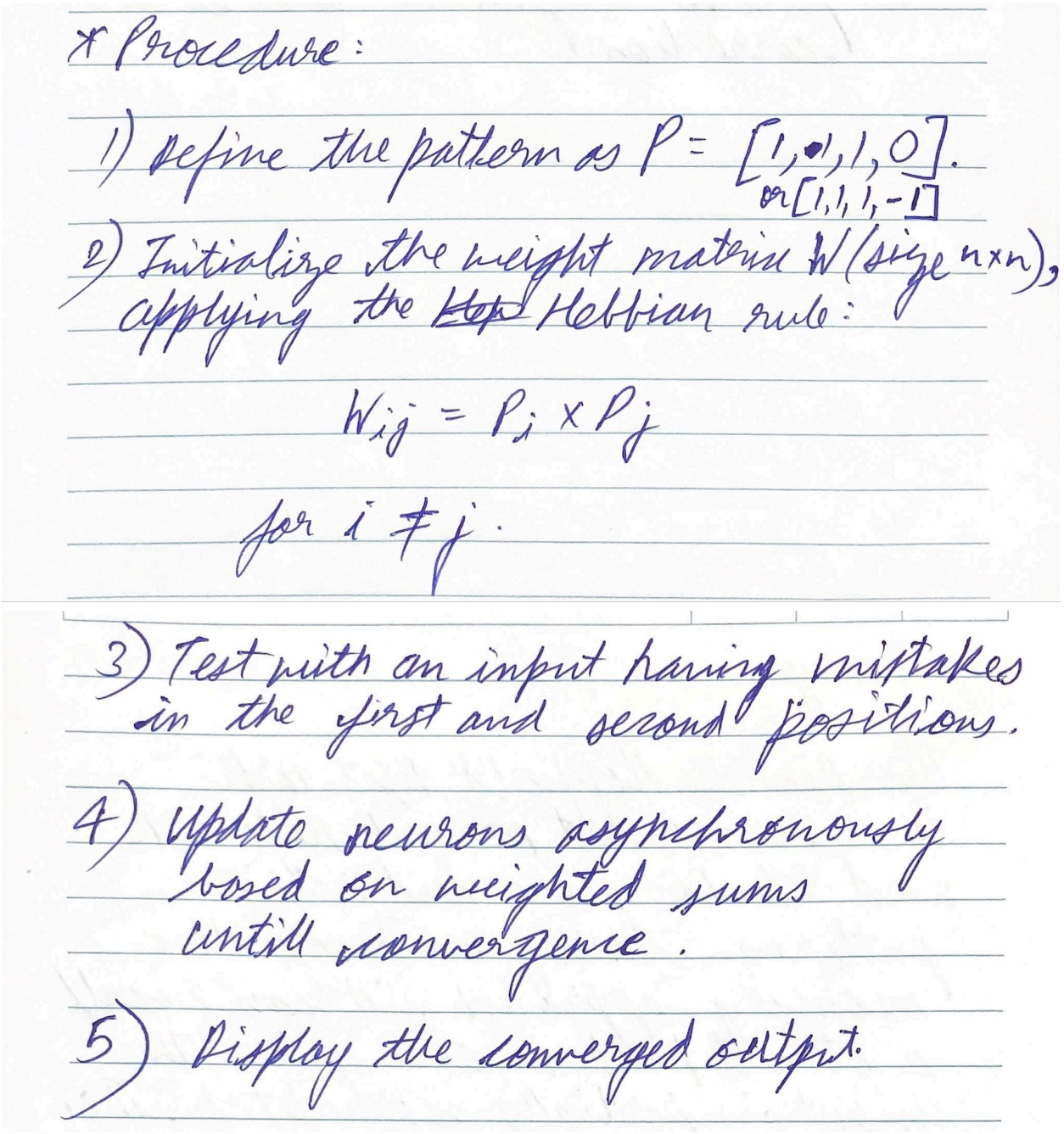
Aim: Implement a program to store a pattern (1 1 1 0). Test the network using Discrete Hopfield Net by giving the input with mistakes in First and Second position

Objective: Students will be able

- To understand practical aspects of Discrete Hopfield model
- To implement in solving pattern recognition problems

* Theory :

The Discrete Hopfield Network is a recurrent neural network used to ~~be~~ store and retrieve patterns. Using an associative memory approach, it can recall a stored pattern even when the input is partially corrupted. This is achieved by stabilizing the network through an iterative update of neuron states, based on a Hebian learning-derived weight matrix.



Expected Output:

convergence has been obtained
the converged output

1 1 1 - 1 (where, -1 represents 0)

Code:

```
% Define the pattern to be stored (P = [1 1 1 0])
P = [1 1 1 -1];  % Representing 0 as -1

% Number of neurons
n = length(P);

% Initialize weight matrix W (n x n) using Hebbian rule
W = P' * P - eye(n);  % Compute the outer product and subtract the
identity matrix

% Test input with minor adjustments to encourage convergence
test_input = [0 1 1 -1];  % Minor alteration to approach the target

% Define the asynchronous update rule for Hopfield Network
max_iterations = 10;  % Set max iterations to prevent infinite loops
S = test_input;  % Start with the test input
for iter = 1:max_iterations
   prev_S = S;  % Store the previous state
   for i = 1:n
       % Compute the weighted sum for neuron i
       S(i) = sign(W(i, :) * prev_S');  % Update based on weighted
sum
       % Avoid any zero values by keeping previous state if result is
zero
       if S(i) == 0
           S(i) = prev_S(i);
       end
   end
   % Check for convergence
   if isequal(S, prev_S)
       disp(['Converged in ', num2str(iter), ' iterations']);
       break;
   end
end
disp('Weight matrix:')
disp(W)
% Display final converged output
disp('Final Output after correction:');
disp(S);
```

Output:

Command Window

```
>> Experiment_12
Converged in 2 iterations
Weight matrix:
     0     1     1    -1
     1     0     1    -1
     1     1     0    -1
    -1    -1    -1     0

Final Output after correction:
     1     1     1    -1

>>
```

Conclusion:

* Conclusion: The discrete Hopfield successfully converged to the stored pattern despite errors in the input, showing its effectiveness in pattern recognition and error correction.