1a) Convert the following decimal number directly to binary. Then, convert the binary to octal.

\[ A = 59 \]

<table>
<thead>
<tr>
<th>GRADE</th>
<th>1/25</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>SUM</td>
<td>/100</td>
</tr>
</tbody>
</table>

b) Convert the following decimal number first to octal. Then, using the octal value, obtain the binary and hex values.

\[ B = 289 \]

1c) Assuming a 16-bit word size and 2’s complement number system, find the binary representation for \(-A\). (Hint: Start with the binary value computed above for \(A\).)
2. Consider the Boolean function \( f = X \uparrow (Y \uparrow Z) \). (Recall the NAND operation, \( A \uparrow B = \overline{AB} \).)

a) Using algebraic manipulations, obtain a simplified sum-of-products expression for \( f \).

b) Use a truth table to compute the original function \( f \), and obtain the sum-of-minterms expression for it.

c) Starting with the above sum-of-minterms expression for \( f \), and applying algebraic manipulations, obtain a simplified sum-of-products expression for \( f \).
3. Consider the following Boolean function:

\[ f(X, Y, Z) = XY + \overline{X}(YZ + \overline{Y}) \]

a) Use a truth table to obtain the sum-of-minterms expression for \( f \). (Show the expression both in decimal form and explicit algebraic form.)

b) Use a map to obtain a simplified sum-of-products expression for \( f \).

c) Use a map to obtain a simplified product-of-sums expression for \( f \).
4a) Draw the 2-level NAND circuit for the following function. Provide a short explanation.

\[ f = XY + \overline{X}Z + W \]

b) Obtain a simplified product-of-sums expression for the above function \( f \).