Answer the questions

1. \( \{a_m\} \) is a sequence of integers such that \( a_1 = 1 \), and \( a_{m+n} = a_m + a_n + mn \), for all positive integers \( m \) and \( n \). What is the value of \( a_9 \)?

2. Find the value of \( A \) following multiplication.

\[
\begin{array}{c}
3 \ A \\
\times A \\
\hline
1 7 \ A
\end{array}
\]

3. If a number is divided by 5, remainder is 2. What should be the last digit of the number?

4. The cost of a book is a two digit number (for example Rs. \( xy \)). Its selling prices has same digits as cost with digits interchanged (Rs. \( yx \)). If its profit margin is divided by 9, find the remainder of division.

Choose correct answer(s) from given choice

5. Lovleen's roll number is a two digit number. Her friend Priyanka's roll number has the same digits as Lovleen's roll number, but with digits interchanged. If they add their roll number, and divide the sum by 11. Find the remainder of this division.
   
a. 1  
b. 2  
c. 0  
d. Can not be determined without knowing the roll number

6. Sachin picks a three digit number and subtract it from the same number after reversing order of its digits. This difference will always be fully divisible by which of following number?
   
a. 9  
b. 21  
c. 10  
d. 18

7. Find the one's digit of the cube of 33002703.
   
a. 7  
b. 6  
c. 10  
d. 3

8. Surjeet picks a three digit number and subtract it from the same number after reversing order of its digits. If this difference is divided by 99, find the remainder.
   
a. 1  
b. 0  
c. 2  
d. Can not be determined without knowing exact number
(9) Find the value of A from following summation.

\[
\begin{array}{c}
A \ 4 \\
+ \ 3 \ B \\
\hline
1 \ 1 \ A \\
\end{array}
\]

a. 7  

b. 9  

c. 6  

d. 8  

(10) Find the value of A from following summation.

\[
\begin{array}{c}
A \ B \\
+ \ 8 \ 7 \\
\hline
1 \ 6 \ A \\
\end{array}
\]

a. 0  

b. 9  

c. 6  

d. 8  

(11) Find the value of Y from following summation.

\[
\begin{array}{c}
5 \ Y \\
+ \ X \ 7 \\
\hline
1 \ 0 \ X \\
\end{array}
\]

a. 9  

b. 8  

c. 7  

d. 6  

Fill in the blanks

(12) If a number is divided by 5, remainder is 3. If same number is divided by 2, remainder is 0. The last digit of the number should be _____.

(13) If 83954y5 is a seven digit number which is divisible by 9, find the value of y = _____.

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**Step 1**
We see that $a_1 = 1$

$a_2 = a_1 + a_1 + 1 = 3$

$a_3 = a_2 + a_1 + 2 = 6$

$a_4 = a_3 + a_1 + 3 = 10$ and so on ...

**Step 2**
Seeing the sequence we can find out the pattern, which is $(\text{num}) \cdot (\text{num}+1)/2$.

**Step 3**
So the value of $a_9$ is $9 \cdot (9+1)/2 = 45$.

(2) A = 5

**Step 1**
Since we see that one's digit of the product of $A \cdot A$, is $A$, so the possible options of $A$ is 1, 5, 6.

**Step 2**
We can see that it is not a case of 1, as the same number is not being replicated as the product. So the possible options are 5 or 6.

**Step 3**
If it is 5, we know the carryover will be 2 as $5 \cdot 5 = 25$.
So we check if $5 \cdot 3 + 2 = 17$. Here it is equal so, $A = 5$.

(3) 2 or 7

**Step 1**
This solution can be explained by an example.

If 12 is divided by 5, the remainder is 2. If 17 is divided by 5 then the remainder is also 2.

**Step 2**
So the last digit could be 2 or 7

**Step 3**
A simple way of remembering it is that the last digit when a number is divided by 5 could be the remainder itself (2) or the $5 + \text{remainder(7)}$. 
Step 1
Let the cost of book is Rs. $xy$. Another way of depicting the cost is $10x + y$.

Step 2
So the selling price of the book will be Rs. $yx$. Another way of depicting the selling price is $10y + x$.

Step 3
So the profit is Selling Price - Cost price. The difference between the two prices would be $9x-9y$ or $9y-9x$. So the price would be $9(x-y)$ or $9(y-x)$, which would be a multiple of 9.

Step 4
Therefore the remainder when divided by 9 will always be 0.
For example - if cost is $46$, then selling price will be $64$. So profit will be $64-46 = 18$. Since 18 is a multiple of 9, so the remainder when divided by 9 will be 0.

Step 1
Let Lovleen's roll number be $xy$. Another way of depicting this is $10x + y$.

Step 2
So the roll number of Priyanka will be $yx$. Another way of depicting it is $10y + x$.

Step 3
So the sum of their roll numbers would be $11x + 11y$ or $11(x+y)$, which is a multiple of 11.

Step 4
So the remainder will always be 0 when divided by 11.

Step 1
Since we have to find the one's digits of 33002703's cube, so all we have to do is find the one's digit of the cube of the number in the one's place.

Step 2
In this case, the one's place is 3. So it's cube is 27. So the one's place is 7, and therefore the one's place for 33002703 is also 7.
(8) b. 0

Step 1
Let the number be xyz. Another way of depicting it $100x + 10y + z$.

Step 2
So when we reverse it, the number would be zyx. Another way of depicting it is $100z + 10y + x$.

Step 3
When we subtract these two numbers, we get $99x - 99z$ or $99z - 99x$, which is $99(x - z)$ or $99(z - x)$.

Step 4
This is a multiple of 9, 11, 99. So the remainder when divided by 99 is always 0.

(9) d. 8

Step 1
We will first evaluate A. We know $A + 3 = 11$. So A can be 8 or 7 (if the case of carryover).

Step 2
Since 8 and 7 is greater than or equal to that of 4, there is no carryover. So A = 8.

Step 3
So $B + 4 = 8$. Therefore $B = 4$.

(10) d. 8

Step 1
We will first evaluate A. We know $A + 8 = 16$. So A can be 8 or 7 (if the case of carryover).

Step 2
Since 8 and 7 is greater than or equal to that of 7, there is no carryover. So A = 8.

Step 3
So $B + 7 = 8$. Therefore $B = 1$.

(11) c. 7

Step 1
We will first evaluate A. We know $X + 5 = 10$. So X can be 5 or 4 (if the case of carryover).

Step 2
Since 5 and 4 is less than that of 7, we know it is a case of carryover. So $X = 4$.

Step 3
So $Y + 7 = 10 + 4$. Therefore $Y = 7$. 
Step 1
We know that when a number is divided by 5 the last digit could be the remainder itself (3) or 5 + remainder (8).

Step 2
We know that if remainder when number is divided by 2 is 0, then the number is even. Therefore the last digit of the number should be even and therefore the answer is 8.

Step 1
The divisibility rule of 9 states that a number is divisible by 9, if the sum of digits of the number is a multiple of 9.

Step 2
So the sum of the digits should be divisible by 9. The sum of the digits turns out to be 34.

Step 3
So the number needed to make it a multiple by 9 is 2.