Question 1:

1.1 A

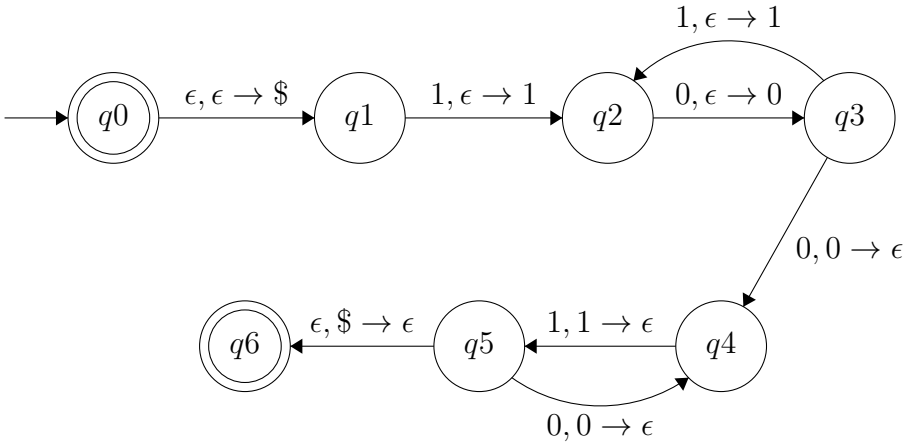
RegEx for:

$M_A = (10)^*$

$M_B = (01)^*$

1.2 B

PDA for $L_{A||B} = \{uv | u \in L(M_A) \bigcap v \in L(M_B) \bigcap |u| = |v|\}$:



1.3 C

Parsing Input: 10100101

Input:														
Stack:	\$	ϵ												$[(q_0 \to q_1) : \epsilon, \epsilon \to \$]$

Input:	**1**													
Stack:	**1**	\$	ϵ											$[(q_1 \to q_2) : 1, \epsilon \to 1]$

Input:	1	**0**												
Stack:	**0**	1	\$	ϵ										$[(q_2 \to q_3) : 0, \epsilon \to 0]$

Input:	1	0	**1**											
Stack:	**1**	0	1	\$	ϵ									$[(q_3 \to q_2) : 1, \epsilon \to 1]$

Input:	1	0	1	**0**										
Stack:	**0**	1	0	1	\$	ϵ								$[(q_2 \to q_3) : 0, \epsilon \to 0]$

Input:	1	0	1	0	**0**									
Stack:	1	0	1	\$	ϵ									$[(q_3 \to q_4) : 0, 0 \to \epsilon]$

Input:	1	0	1	0	0	**1**								
Stack:	0	1	\$	ϵ										$[(q_4 \to q_5) : 1, 1 \to \epsilon]$

Input:	1	0	1	0	0	1	**0**							
Stack:	1	\$	ϵ											$[(q_5 \to q_4) : 0, 0 \to \epsilon]$

Input:	1	0	1	0	0	1	0	**1**						
Stack:	\$	ϵ												$[(q_4 \to q_5) : 1, 1 \to \epsilon]$

Input:	1	0	1	0	0	1	0	1						
Stack:	ϵ													$[(q_5 \to q_6) : \epsilon, \$ \to \epsilon]$

Input Accepted.

Question 2:

2.1 A

Grammar for $L_1 = \{1^n 0^{2n} | n \geq 0\}$:

$S \rightarrow 1S00|\epsilon$

2.2 B

Considering the string $w = 1^p 0^{2p} \in L_1$:

For a split into the parts $uvxyz$, the pump-able segment v must consist of only 1, so $v = 1$ and segment y must consist of only 00, $y = 00$. So when you pump both segments as follows: $uv^i xy^i z \ \forall i \geq 0$ the condition that there are two times as many 0's as 1's will hold.

2.3 C

Considering the string $w = 1^p 0^{2p} 1^p \in L_1$:

There are a number of possible cases for a split into the parts $uvxyz$.

One is that the pump-able segment v would consist of 1, so $v = 1$ and segment y would consist of 00, so $y = 00$. This is not pump-able since the succeeding number of 1's wont equal the preceding number.

Another is that the pump-able segment v would consist of 10, so $v = 10$ and segment y would consist of 1, so $y = 1$. This is not pump-able since the succeeding number of 0's wont be twice the number of preceding and succeeding 1's.

Another is that the pump-able segment v would consist of 1, so $v = 1$ and segment y would consist of 01, so $y = 01$. This is not pump-able since the number of 0's wont be twice the number of preceding and succeeding 1's and they would be out of order.

Another is that the pump-able segment v would consist of 10, so $v = 10$ and segment y would consist of 01, so $y = 01$. This is not pump-able since the values would be out of order.

So in any condition, if you pump both segments as follows: $uv^i xy^i z \ \forall i \geq 0$ the condition that there are n 1's followed by $2n$ 0's followed by n 1's again can't possibly hold.