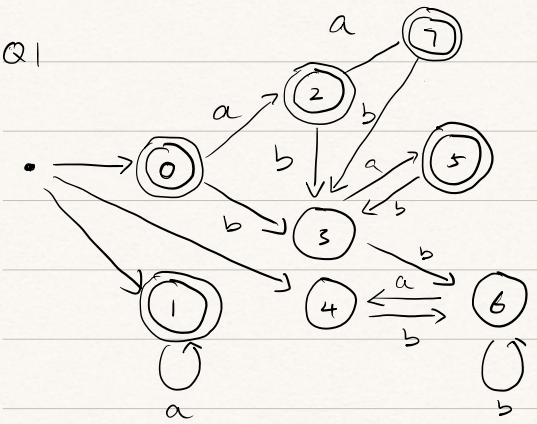
Q1



Q2.

Q3:

a) Let n be a constant defined by pumping lemma, picking the string $z = a^p \in L$ and p is a prime integer. Decomposing $z = uvw$, and $u = a^{p-i-j}$ $v = a^i$ $w = a^j$. So $uv^k w = a^{p+(k-1)i}$. Consider $uv^{p+1}z$, which is $a^{(p+1)i}$, $(p+1)i$ is not prime, so $a^{(p+1)i} \notin L$ and L is not regular by pumping lemma.

b) Let c be a constant defined by pumping lemma, picking the string $z = a^c \in L$ and c is a composition integer. Decomposing $z = uvw$, and $u = a^{c-i}$, $v = a^i$, $w = a^j$. So $uv^k w = a^{(c+(k-1)i}$. Consider $k = \frac{1-c}{i} + c$, $z = uv^{\frac{1-c}{i}+1}w = a \notin L$. So L is not a regular by pumping lemma.

c) Let n be a constant defined by pumping lemma. Picking

the string $z = a^n b^n \in L$. Decomposing $z = uvw$, and $u = a^{n-i}$, $v = a^i$, $w = b^n$. So $uv^k w = a^{n-i} a^{ik} b^n = a^{n+(k-1)i} b^n$. Consider $k = 0$, then $z = uv^0 w = a^{n-i} b^n$, since $i > 0$, $n - i < n$ and L is not regular from pumping lemma.

Q4: L is not regular.

Let n be a constant defined by pumping lemma, picking the string $z = [a,b]^i [a,b]^j ([a,b]^k)^n \in L$, and $i = k$. So $z = uvw$, $u = [a,b]^i [a,b]^j$, $v = [a,b]^c$, $w = [a,b]^{kn-c}$.