Spring 2014

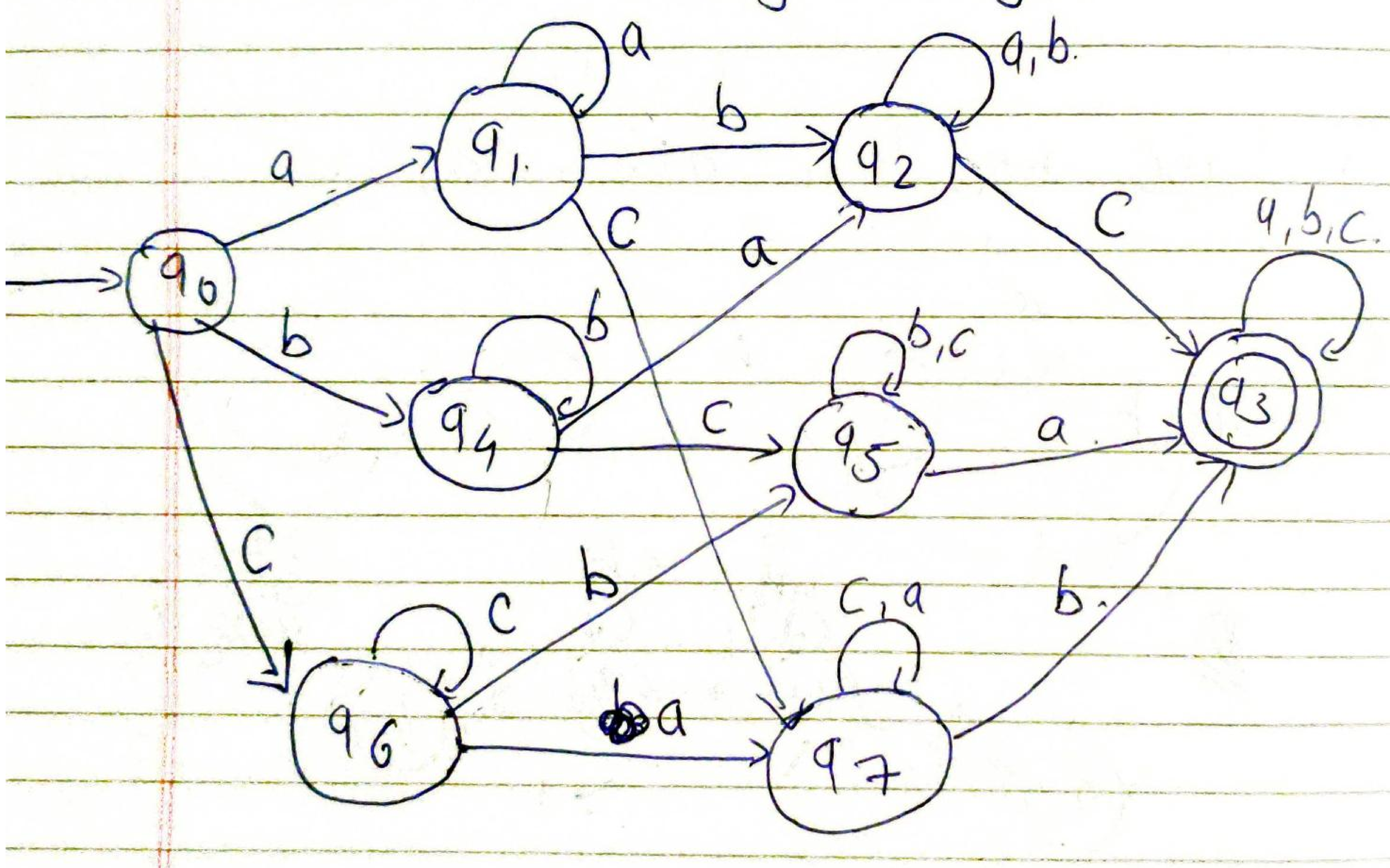
Q.1 → Give the ------

→ Given!

input =

$\Sigma = \{a, b, c\}$

$L_1 = \{ w : w$ containg at least one a, one b and one c in any order $\}$.



Q) - prove that following ......

→ ~~Cd~~ prove the language is not ~~cek~~ context free using pumping lemma.

m

Use steps below to prove ~~ef~~ above using pumping lemma.

→ 1) Assume that language (L) is context free.

2) It has to have a pumping length (p).

3) All strings longer than p can be pumped $|s| \geq p$

4) Now, find a string 's' in A such that $|s| \geq p$.

5) Divide S into u, v, x, y, z.

6) show that

$uv^ixy^iz \notin A$ for some i.

7) Then consider the ways that S can be divided into uvwxyz.

$a v^i x y^i z$

8) Show that none of these can satisfy all 3 pumping lemma conditions at same time.

that are

1) $u^i . v x y^i . z$ is in A for every $i \geq 0$

2) $|vy| > 0$

3) $|vxy| \leq p$

9) s cannot be pumped ⇒ contradiction.

$L = \{ w : w$ contains the same no. of a's, b's and c's in any order $\}$

a^N, b^N, c^N

1) Assume, L is context free

2) L must have a pumping length (p)

3) Take s such that $S = a^p b^p c^p$.

ii) Divide S into u, v, x, y, z.

take p = 4.

So, $S = a^4 b^4 c^4$

case 1

v & y each contain only one type of symbol

a aaa a bbbb c c cc
u v x y z

uv^ixy^iz (i = 2).

uv^2xy^2z

a aaaa a bbbb c c c c c
u v² x y

$a^6 b^4 c^5 \notin L$

here no of ~~a ≠ b~~ a's, b's & c's are not equal.

This does not belong to language L given.

as, this condition is not satisfied it is not context free.

∴ L is not context free.

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case II.

$$\underbrace{a\,a}_{u}\;\underbrace{a\,a\,b\,b}_{v}\;\underbrace{b}_{x}\;\underbrace{b}_{y}\;\underbrace{c\,c\,c\,c}_{z}$$

$u v^i x y^i z \quad (i = 2)$

$a\,a\,a\,a\,b\,b\,a\,a\,b\,b\,b\,b\,b\,c\,c\,c\,c \notin L$

as pattern ~~$a^N b^N$~~ $a^N b^N c^N$ is not there in above string.

~~∴~~ above string is not in language and condition 1 fails.

∴ thus, Language L is not context free.

Q.3 → Let $A_{TM} = \{M, w: \cdots$

→ We can show it like for input.
Let $<M, W>$ to ATM, we transform it into an input of TWOTM.
Lets there be a function f which takes $<M, w>$ as input and produce another Turing Machine M_1 as output.

$$f(<M, w>) = M_1$$

This M_1 will be the input to TWOTM.

Now lets M_1 rejects all ~~other~~ input other than 1, w.
on input 1 it accepts it and for input w it runs M on w.
so if M1 in TWOTM, means M1 accepts only 2 strings which imply M must accept w.

Thus, ATM <= TWOTM.