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# Quiz 2 EE5151 NOV-2019

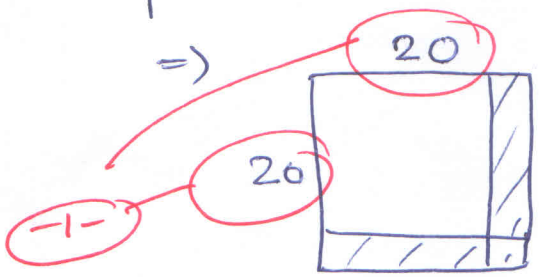
1. (3+3 = 6 marks)

Error Burst length
$L = 21$ (, )

(a) $K = 405$ ⟵ inter-burst interval

we need # of columns $\geq L-1 = \geq 20$
and the matrix to be as "square" as possible to maximise rate

=>




$n = 20 \times 20 = 400$;
$k = 19 \times 19 = 361$;
$(n-k = 39)$

$\therefore$ Code rate $r = \frac{k}{n} = \frac{361}{400} =$ 0.9025 ;

-2-

(b) $K = 482$

→ In this case $22 \times 22 = 484$ exceeds 482 and hence cannot be used

→ Choices are

(i) $21 \times 21 \longrightarrow \frac{400}{441} = 0.90703$

(ii) $21 \times 22 \longrightarrow \frac{420}{462} = 0.9091$

(iii) $20 \times 24 \longrightarrow \frac{437}{480} =$ 0.9104

-1-

-2-

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2. [1 + 1.5 + 1 + 1.5 + 1 + 1 = 6 marks]

The middle-of-the frame marker does not change the behaviour of the serial search algorithm.

(a) Given $p = P(1)$ and $q = P(0)$ and alternating "1010" marker:

Avg. # of frames elapsed before Mis-match is detected

$$A = \frac{1 + 2pq}{1 - pq}$$

-1-

(b) With $p = 0.1$ & $q = 0.9$

$$A = \frac{1 + 0.18}{1 - 0.09} = 1.297$$

For $N = 100$ bits, and each bit with $T = 20\mu s$

(Avg.) Frame Time $= \left(\frac{N}{2} \cdot A\right) \cdot \frac{N}{2} + \frac{N}{2}$

$$= \frac{100^2}{2} \times 1.297 + 50 = 6535\,T$$

$$\Rightarrow F_1 = 0.1307 \text{ sec} \quad \checkmark\ 6535 \times 20\mu$$

-1.5-

Note: For alternating marker, even if $p$ & $q$ interchange (i.e. $p = 0.9$ & $q = 0.1$), A won't change, and $F_1$ won't change

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2. contd

(c) For "111..." marker pattern

Avg. # of frames adopted before mismatch

$$A = \frac{p}{1-p}$$

where $p = \frac{1}{2^L} = \frac{1}{2}$ (since $L = 1$)

-1.5-

(d) For $p = 0.1$ & $q = 0.9$

$$A = \frac{0.1}{0.9} = 0.111$$

$$F_2 = \left(\frac{10^2}{2} \times (0.111) + 50\right) \times 20\mu$$

$$= \boxed{0.01211 \text{ sec}}$$

-1-

(e) For $p = 0.9$ & $q = 0.1$

$$A = \frac{0.9}{0.1} = 9$$

& $F_3 = \boxed{0.901 \text{ sec}}$

-1-

Discussion: Since $p = 0.9$ and marker is also "111" → the acquisition time will be higher (since false-alarm ~~rate~~ rate is higher) !! -0.5-

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3. [5 marks]

(i) Buffer Status

(1, 5) → (3, 7) → (5, 9) → (5, 9) → (6, 10)

-0.5- -1- -0.5-

(ii) SN

1, 2, 3, 4 | 5, 6, 7

-1-

(iii) RN

1, 1, 2 | 3 5 5 6 7

-2-

4. [3 marks]

20 Mbps link (Bipolar Mod.) ⇒ Symbol Time $T = \frac{1}{20 \times 10^6} =$ 0.05 μsec

Packet Time = 500T = 25 μsec
(500 bit)

∴ RTT width of packet ($\beta$) $= \frac{1.5 \text{ msec}}{25 \mu\text{s}} =$ 60 packets

-2-

SN → $2\beta$ → 120 ⇒ 7 bits (8)

RN → $\beta$ → 60 ⇒ 6 bits (7)

-1-