CSE Qualifiers 2005 (JUNE)

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Algorithms:

1. a) Definitions: Connected Graph.
   Connected component
   Spanning tree
   MST

   b) Give an algorithm to find the #components in a graph. Use algorithm to trace following adj matrix and show that #components in this example is 2.

   A[,] = [-Given-]

   c) Sample Graph Given. (15 nodes)
   Find MST using Kruskal's Alg.

   d) What special datastructures are used in kruskal
   Explain how they are used in kruskal's alg.

2. a) Define: NP
   Class Co-NP
   Class NP-complete.

   b) State Cook's theorem.

   c) Show CNFSAT $\propto$ CLIQUE.

Operating Systems:

1. K = #frames = 4.
   Stream is : 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5

   a) Show page replacements, #faults, #hits in FIFO, LRU. Show data structures used

   b) Give an algorithm OPT which will give minimum #faults provided the entire stream is known in advance.

c) What is Belady's anomaly?
show it for an algorithm for above referen
stream.

d) Let $\{p_0, p_1, \ldots p_n\}$ be a page reference stream
K - # frames in memory.
C_K - minimum constant
Show that:

$$\begin{bmatrix} \text{\# faults for } \{p_0, \ldots p_n\} \\ \text{using FIFO} \end{bmatrix} \geq C_K \times \begin{bmatrix} \text{\# faults for } \{p_0, \ldots p_n\} \\ \text{using OPT} \end{bmatrix} + b_0$$

b_0 - constant.

Show that $C_K = K$.

2. 3 strategies : 1) No Preemption
2) Preemption without timeslice
3) Preemption, ts = 2ms.

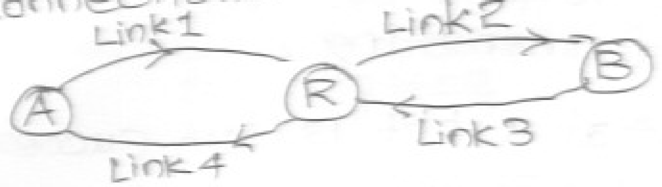
Job	Arrival	CPU(req)	Priority
1	0	4	1
2	1	3	2
3	2	2	3
4	2	3	2
5	3	4	1

Each process gets an I/O request every 1ms.
Each I/O request takes 2ms to complete.
Enough I/O devices so that processed need not compete for I/O device.

Find for each strategy,
throughput, waiting time, turnaround time
and compare.

ORKS:

CP Connections



→ Link 1 & 4 : 100 Mbps
Link 2 & 3 : 10 Mbps

→ A sends a very large file to B. Data travels via A to R to B in link1 & link2. ACK from B comes in link3 & link4.

→ Congestion Window size initially 16Kb (??)

→ Data Segment size (including headers) = 1280 bytes
Ack size is 0.

→ Prop delay on each link = 10ms.

→ R has buffer of 10 packets and does tail drop queuing.

→ B has 1 packet buffer.

a) What is the min time between 2 ACK received at A.

b) What is the RTT.

c) If CW is quadrupled what will happen to throughput

d) If A is transmitting packet 15, where will other packets be? what is the state of R?

2.

a) Large # users use ALOHA with 50 requests/second.

Time is slotted at 40 ms.

p - probability of transmitting.

i) What is the prob. that a pkt is txn successfully?

ii) Wt is the prob. that k collisions occur and then packet is transmitted successfully?

iii) Wt is the avg # txn for successful txn?

b) P - Primary

S - Secondary.

→ System uses rollcall polling.

→ There are N secondaries.

→ $\alpha = \frac{delay_{prop.}}{delay_{txn}}$. → $delay_{prop}$ is the prop. delay from P to last S.

ii) If only one S wants to transmit data (last S) ??

show that

$$throughput \approx \frac{1}{1+N\alpha}$$

i) If all S are ready to transmit data

show that

$$throughput \approx \frac{1}{1+\alpha}$$