K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
I SESSIONAL TEST QUESTION PAPER 2019 – 20 ODD SEMESTER

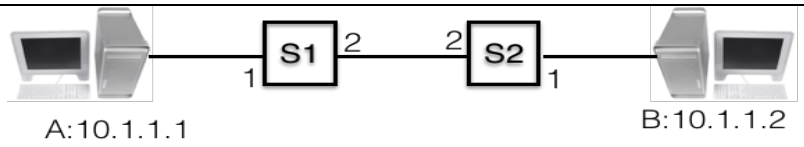
SET – A/B

USN										

Degree : **B.E** **Semester** : **V**
Branch : **Computer Science & Engineering** **Course Code** : **17CS52**
Course Title : **Computer Networks** **Date** : **21-Oct-2019**
Duration : **90 Minutes** **Max Marks** : **30**

Note:
1. **Answer ONE full question from each part.**
2. **This is an open book exam. Any printed material, handwritten notes etc. is allowed.**
3. **Sharing of books, notes, printed material is not permitted.**
4. **Use of calculator is permitted, but no other electronic gadget is permitted.**

Q No.	Question	Marks
	PART-A	
1(a)	Suppose within your web browser you click on a link on website http://ksit.edu.in to obtain a web page http://ksit.edu.in/cse.html. Suppose that this web page is redirected N times on the same host (where `N=x+5`, where `x=ddd%5`, where `ddd` corresponds to last 3 digits for your USN number), such as 1st redirect is to `cse2.html`, 2nd redirect is to `cse3.html` and so on till `cseN.html`. Each of this respective web page access take round trip time of 1 second, 2 seconds, …, N seconds. Further, suppose that the final web page `cseN.html` contains `N` embedded images with urls as http://img.ksit.edu.in/img1.jpg, http://img.ksit.edu.in/img2.jpg, …, http://img.ksit.edu.in/imgN.jpg., and round trip time for img.ksit.edu.in is 2s. Consider that your browser is configured to make N parallel persistent connections. **Analyze** these HTTP accesses w.r.t. RTT and **compute** the total time taken when the client clicks on the link until the web page is rendered with all embedded objects. Note: Example for computation of N. If your USN is 1KS17CS031, then N=5+31%5+5+1=6. If your USN is 1KS16CS112, then N=5+112%5 = 5+2=7.	**5**
Sch & Ans	Sch: 2 marks for analysis, 3 marks for computation. Ans: Consider USN as 1KS17CS031. Then ddd=031, and thus N=6. The redirection will be as per following URLs http://ksit.edu.in/cse.html →http://ksit.edu.in/cse2.html. http://ksit.edu.in/cse2.html →http://ksit.edu.in/cse3.html. http://ksit.edu.in/cse3.html →http://ksit.edu.in/cse5.html. http://ksit.edu.in/cse4.html →http://ksit.edu.in/cse4.html. http://ksit.edu.in/cse5.html →http://ksit.edu.in/cse6.html. The web page http://ksit.edu.in/cse6.html has 6 embedded images Each directions requires 1 RTT, and thus time taken for these 6 web accesses 1(TCP)+1+2+3+4+5+6=22s. The last web page has 6 embedded images and thus 5 new connections are established which takes 1s. The remaining 5 images on 5 new connections will take 2s. Thus, total time taken = 22+1+2=24s	
(b)	TCP is considered as a streaming and reliable protocol. Consider the following network setup.	**5**



Consider that TCP application at host A sends 8 messages, each message of 10 bytes every 2 seconds to application at host B. The content of these 8 messages are follows:

```
T0: AAAAAAAAAA
T2: BBBBBBBBBB
T4: CCCCCCCCCC
T6: DDDDDDDDDD
T8: EEEEEEEEEE
T10: FFFFFFFFFF
T12: GGGGGGGGGG
T14: HHHHHHHHHH
```

The application at B reads a maximum of 30 bytes every 2 seconds and displays the data read from the TCP socket. Consider that link between switch S1 and S2 is broken at time T=5s and restored at time T=9s. Knowing that TCP is reliable and streaming protocol, **determine** what message content would be displayed (i.e. values corresponding to ??) at host B every 2s. You can assume that there is no propagation, transmission, queuing and processing delay in the network.

```
T0: ??
T2: ??
T4: ??
T6: ??
T8: ??
T10: ??
T12: ??
T14: ??
```

Sch & Ans

Sch: 1 mark for up to T4. 2 marks for T6 to T10. 2 marks for T12 and T14.
Ans:

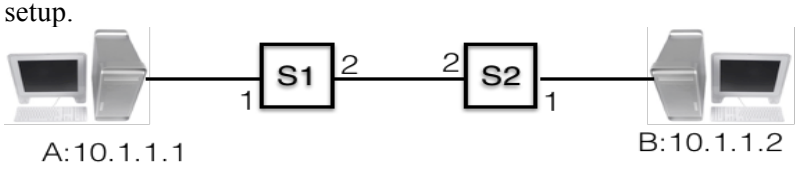
```
T0: AAAAAAAAAA
T2: BBBBBBBBBB
T4: CCCCCCCCCC
T6:  (None)
T8:  (None)
T10: DDDDDDDDDDEEEEEEEEEEFFFFFFFFFF
T12: GGGGGGGGGG
T14: HHHHHHHHHH
```

(c)

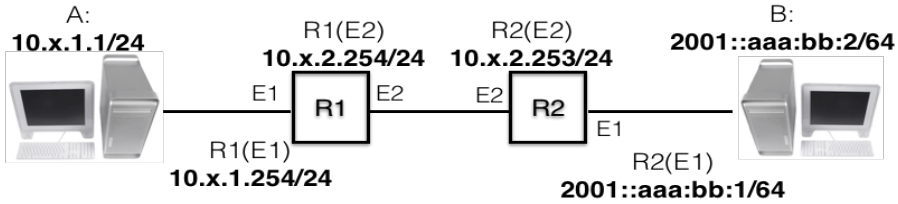
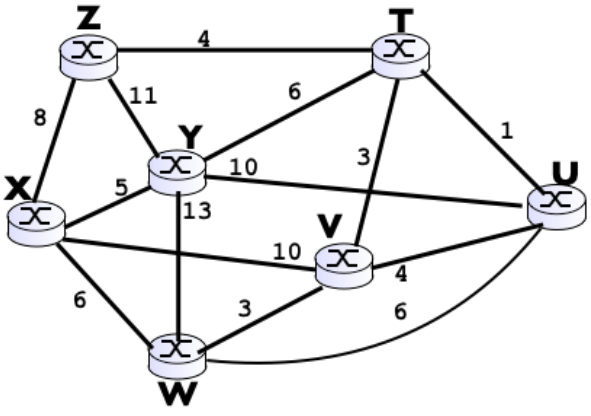
Consider TCP header format as per TCP protocol (RFC 793).

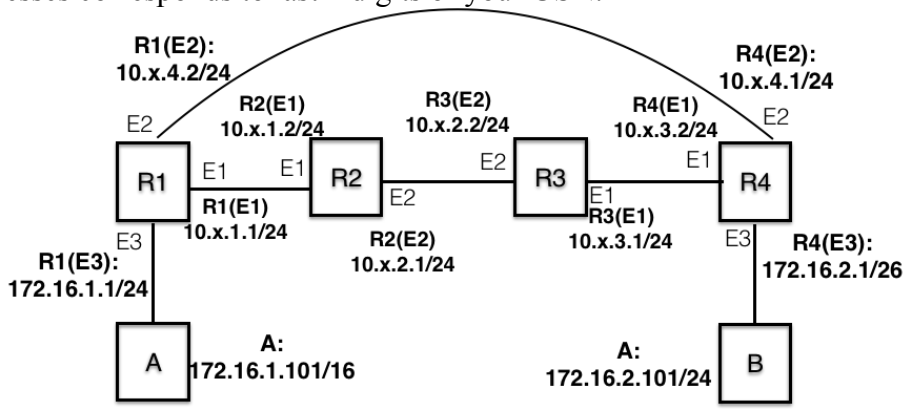
```
  0                   1                   2                   3
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Source Port          |       Destination Port        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Sequence Number                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Acknowledgment Number                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Data |           |U|A|P|R|S|F|                               |
| Offset| Reserved  |R|C|S|S|Y|I|            Window             |
|       |           |G|K|H|T|N|N|                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Checksum            |         Urgent Pointer        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Options                    |    Padding    |
```

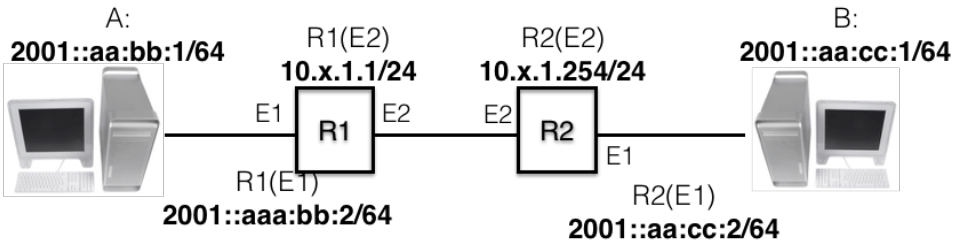
	<pre>+-+
	| data |
	+-+</pre>	

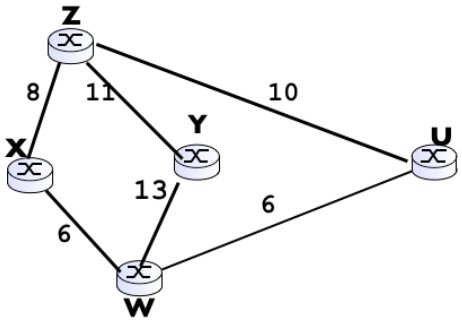
	You are given the following wireshark capture corresponding to TCP protocol (complying with TCP header format given above). `0050 c4a6 0a89 4d85 ea44 de48 5011 ffff 5c02 0000 0000 0000 0000` For this packet capture, **determine** the following i. Source Port number (in decimal) ii. Which of the TCP flags bits are set iii. What is value of receive window size (in decimal)? iv. What is the length of TCP header v. What is the value of urgent pointer (in decimal)	**5**
Sch & Ans	Sch: 1 mark for each question. Ans: Src port: `0x0050 = 8020` (decimal) TCP Flags: `0x11` → `Ack, FIN` Receive window size: 0xffff = 65535 `20` (decimal) Length of TCP header = Data offset = `0x05 = 20` (decimal) Urgent pointer = `0x0000 = 0` (decimal)	
	OR	
2(a)	Consider a network consisting of a server and 20 peers. A file of size 50MBytes (1byte=8bits) lying with a server is to be distributed to all 20 peers using P2P communication architecture. The server upload speed is 10Mbps and each peer upload speed is 2Mbps. Each peer download speed is 20Mbps. Assuming underlying network has unlimited capacity, **evaluate** the minimum time required to distribute the file using a single chunk to all peers and analyze your computation mechanism.	**5**
Sch & Ans	Sch: ½ mark for time interval computation Ans: Time taken from server to any one peer: 50*8*10^6/(10*10^6)=40s Time taken by peer to transfer file to another peer: 50*8*10^6/(2*10^6)=200s T0: Number of peers having file: 0 T40: Number of peers having file: 1, 1 peer starts transmitting T80: Number of peers having file: 2, 2nd peer starts transmitting T120: Number of peers having file: 3, 3rd peer starts transmitting T160: Number of peers having file: 4, 4th peer starts transmitting T200: Number of peers having file: 5, 5th peer starts transmitting T240: Number of peers having file: 7 T280: Number of peers having file: 9 T320: Number of peers having file: 11 T360: Number of peers having file: 13 T400: Number of peers having file: 15 T440: Number of peers having file: 18 T480: All peers get the file	
(b)	TCP is considered as a streaming and reliable protocol. Consider the following network setup.  Consider that TCP application at host B sends 7 messages each of 10 bytes every 2s as follows: `T0: AAAAAAAAAA`	**5**

	T2: BBBBBBBBBB T4: CCCCCCCCCC T6: DDDDDDDDDD T8: EEEEEEEEEE T10: FFFFFFFFFF T12: GGGGGGGGGG The application at B issues a read request to read maximum of 4 bytes every 2 seconds and displays the data read from its socket. Knowing that TCP is a reliable and streaming protocol, **determine** that message content that would be displayed (values corresponding to ??) at host B every 2s. You can assume that there is no propagation, transmission, queuing and processing delay in the network. T0: ?? T2: ?? T4: ?? T6: ?? T8: ?? T10: ?? T12: ??	
Sch & Ans	Sch: 1 mark for each time (max of 5) Ans: T0: AAAA T2: AAAA T4: AABB T6: BBBB T8: BBBB T10: CCCC T12: CCCC T14: CCDD T16: DDDD T18: DDDD : :	
(c)	Consider the case that an application at host A needs to communicate with an application at host B using TCP to send a single message having 10 bytes of data as "ABCDEFGHIJ". Application at B acts as receiver only and does not send any application data. Assume that TCP connection at A uses ISN (Initial Sequence Number) value of 1000, and TCP connection at B uses ISN value of 2000. Assume that network is reliable and error free i.e. no packet corruption, loss or duplication, and in order delivery. **Construct** the TCP timeline sequence diagram for this TCP connection between A and B (covering connection setup, data transfer and teardown), and for each communication on this timeline sequence, **identify** the following field values: i. Sequence number ii. Acknowledgement number iii. TCP Flags	**5**
Sch & Ans	Sch: 2 marks connection setup, 2 marks for tear down, 1 mark for data transfer Ans: Call setup A→B; Flag=Syn; Seq=1000, Ack=0 (NA) B→A; Flag=Syn, Ack; Seq=2000, Ack=1001 A→B; Flag=Ack; Seq=1001, Ack=2001 Data Transfer A→B; Flag=Ack; Seq=1001, Ack=2001 (data: ABCDEFGHIJ) B→A; Flag=Ack; Seq=2001, Ack=1011	

	Connection Close: A→B; Flag=Fin,Ack; Seq=1011, Ack=2001 B→A; Flag=Ack; Seq=2001, Ack=1012 B→A; Flag=Fin,Ack; Seq=2001, Ack=1012 A→B; Flag=Ack; Seq=1012, Ack=2002	
	PART-B	
3(a)	Consider the following network where x corresponds to last 2 digits of your USN.  Host A wants to communicate with host B. Explain which IPv6 transition strategy needs to be used to enable this communication between A and B. **Identify** the device or devices among A, R1, R2, B where this transition strategy will be implemented and **explain** your reasoning.	**5**
Sch & Ans	Sch: 2 marks for transition strategy, 2 marks for device identification, 1 mark: reason Ans: The NAT64 transition strategy would be used. The device to be used would R2. Reason: Since A is using IPv4, and B is using IPv6, hence NAT64. R2 is the device having IPv4 address on one side, and IPv6 address on other side.	
(b)	Consider the following network consisting of 7 routers with their edge costs depicted along the edges. Use Dijkstra's shortest path algorithm to compute the shortest path from router Z to all other routers. **Show** how the algorithm works at each step of the iteration i.e. i) show the value of set N' (the subset of nodes for whom least cost path is already computed), ii) D(v) the cost of the least cost path from node to destination v, and iii) its predecessor p(v) 	**5**
Sch & Ans	Sch:1 mark for each step after the first step (max 5) Ans: N' | D(x), P(x) | D(y), P(y) | D(T),P(T) | D(w),P(W) | D(V),P(V) | D(U),P(U) Z | 8,z | 11,z | 4,z | ∞ | ∞ | ∞ ZT | 8,z | 10,T | - | ∞ | 7,T | 5,U ZTU | 8,z | 10,T | - | 11,U | 7,T | - ZTUV | 8,z | 10,T | - | 10,V | - | - ZTUVX | - | 10,T | - | 10,V | - | - ZTUVXY | - | - | - | 10,V | - | - ZTUVXYW | - | - | - | - | - | -	
(c)	Consider the following network consisting of 4 routers and two hosts. The x in the	**5**

	IP addresses corresponds to last 2 digits of your USN.
	 
	
	The default gateway for host A is 172.16.1.1, and default gateway for host B is 172.16.2.1. The default gateway for each of the router is as follows.
	R1: `10.x.1.2;` R2: `10.x.2.2;` R3: `10.x.3.2;` R4: `10.x.4.2`
	The other routing entries for router correspond to their locally connected networks without any destination gateway. For example, for Router R2, the complete routing table entries are
	Dstn N/w Mask Gateway Interface
	`10.x.1.0 /24 - E1`
	`10.x.2.0 /24 - E2`
	`0.0.0.0 /0 10.x.2.2 E2`
	
	The other routers have similar entries corresponding to their locally connected network. Consider that host A sends one ping packet to host B i.e. with destination IP as 172.16.2.101, having a TTL value of 10 (in IP header).
	Determine if this packet will be delivered to host B or not. If it is delivered, what will be TTL value when it is received by B. If it is not delivered to host B, then determine destiny of this packet.	

Sch & Ans	Sch: 2 marks for delivery answer, 3 marks for packet destiny. Ans: Since subnet mask of R4(E3) is /26, thus, IP address 172.16.2.101 is not in this range and packet will be routed using default route on E2. Thus packet will keep on looping till TTL becomes zero. Thus this packet will not be delivered to B. The TTL will become zero when packet reaches R2 on its 3rd iteration and will be discarded by R2.	
	OR	
4(a)	Consider the following network where x corresponds to last 2 digits of your USN number.  An application at host A wants to communicate with application at host B. Identify which IPv6 transition strategy needs to be used to enable this communication between A and B and on which device(s). Consider that A sends one UDP packet to B. **Illustrate** the source and destination IP address for this UDP packet transmission at each of the link in this network.	**5**
Sch & Ans	Sch:1.5 marks for link A-R1, 2 marks link R1-R2, 1.5 marks for link R2-B Ans: Link A-R1: `Src IP: 2001::aa:bb:1, Dst IP: 2001::aa:cc:1` Link R1-R2: `Src IP: 10s.1.1, Dst IP: 10.x.1.254`	

	Link R2-B: `src IP: 2001::aa:bb:1, Dst IP: 2001::aa:cc:1`	
(b)	Consider the following network and assume that each node initially knows the costs to each of its neighbors. Consider the distance vector routing algorithm and **show** the distance table entries at node **Y** after exchange of routing messages in each iteration step.  	**5**
Sch & Ans	Sch: 2 marks for 1st iteration, 2 marks for 2nd iteration, and 1 marks for 3rd iteration Ans:: The routing entries for Y at each iteration would be as follows Iteration 1 Iteration 2 Iteration 3	

Iteration 1

	U	W	X	Y	Z
Y	∞	13	∞	0	11
Z	10	∞	8	11	0
W	6	0	6	13	∞

Iteration 2

	U	W	X	Y	Z
Y	19	13	19	0	11
Z	10	14	8	11	0
W	6	0	6	13	14

Iteration 3

	U	W	X	Y	Z
Y	19	13	19	0	11
Z	10	14	8	11	0
W	6	0	6	13	14

(c)	Consider that you as an IT Administrator have been asked to take a backup of all the 100Giga Bytes data of `cse.ksit.edu.in` server to a backup server at `cse.kssem.edu.in`. You have two choices to transfer the data. Choice A: First one is take a backup on portable SDD hard disk at KSIT which takes 30 minutes, carry it to KSSEM by your own transport (car) which takes another 30 minutes and then copy from the SDD hard disk to the backup server at KSSEM which takes another 30 minutes. Choice B: use the ISP (Internet service provider) link that provides a reliable TCP connection throughput of 100Mbps. **Identify** the choice that you will make to achieve your task and explain your reasoning.	**5**
Sch & Ans	Sch: 2 marks for time computation using SDD mechanism, 2 marks for computation using ISP and mark for identifying choice Ans: Time taken using SDD and physical transport: 30+30+30 = 1hr 30 minutes Time taken using ISP: 100*8*10^9/(100*10^6) = 8000s = 2hrs 13 mins 20s. Thus, physical transport using SDD and transport by car would be faster.	