

**Solutions string: ADBBDDDCDBBABCCCD**

**Multiple-choice questions**

1. **What is one of the problems with SONET/SDH networks?:**
  - A. Bandwidth management is rigid..
  - B. They are not suitable for an implementation based on optical fibers.
  - C. They are not suitable to implement ATM or frame Relay networks.
  - D. They cannot achieve high transmission speed.
  
2. **What can be done with a VPN (virtual private network) based on SSL (secure socket layer)?**
  - A. To distribute, in secure way, over several servers the workload related to a web based application
  - B. To implement clusters of private networks
  - C. To implement a backbone of an internet service provider for providing an interconnection service, in a simple and effective way
  - D. It is possible for an enterprise to make available in a secure way some applications over the corporate network
  
3. **What is a feature of a layer 3 VPN (virtual private network) implemented using an MPLS network?**
  - A. High security standards.
  - B. High level of scalability.
  - C. It does require a NAT (network address translation) when private addresses are used.
  - D. QoS guaranteed for a flow travelling across the VPN
  
4. **Which operations can be performed on a label by a single MPLS router?:**
  - A. Add a label in any position (PUSH), drop one label in any position (POP), change the value of a label in any position (SWAP).
  - B. Add an external label (PUSH), drop the external label (POP), change the content of the external (SWAP)
  - C. Add a label if the router is the ingress one (only 1 label is allowed) (PUSH), drop the only label if the router is the egress one (POP), change the content of the only label present (SWAP).
  - D. Labels cannot be manipulated by MPLS routers.
  
5. **What is a LSP (label switched path) in the MPLS (multi-protocol label switching) architecture?**
  - A. It is a set of alternative paths used to reach a specific destination.
  - B. It is a type of message exchanged among routers to understand the network topology.
  - C. It is the shortest possible path for a given destination.
  - D. It is created for transmitting packets belonging to a forwarding equivalence class (FEC)

**6. If we apply to a flow of packets the token bucket (or leaky bucket), algorithm with capacity K and inserting token every  $1/W$  sec, what is the final effect?**

- A. The maximum burst size allowed is W.
- B. All the packets of this flow will be routed on the same path (i.e. out of order arrival is eliminated).
- C. It will be possible to implement traffic engineering mechanisms to this flow of packets..
- D. The maximum burst size allowed is K

**7. What is possible to do with the RTCP protocol?:**

- A. It is possible to limit the jitter.
- B. It is possible to communicate to other routers the profile of the traffic generated by a transmitter.
- C. It is possible to reserve resources to obtain guaranteed QoS.
- D. It is possible to monitor the number of losses of a specific flow of packets.

**8. What is a feature of the DiffServ (Differentiated Services) architecture?**

- A. Sophisticated signalling protocols for resource reservation.
- B. Possibility to provide guaranteed QoS for packet flow explicitly requesting it.
- C. A mechanism to provide different type of treatment to packets belonging to different service classes.
- D. Sophisticated signalling protocols to make sure that each flow will receive a guaranteed QoS.

**9. What is a feature of ATM networks?:**

- A. They do not allow fragmentation of long packets
- B. They provide a datagram based packet forwarding.
- C. They allow a unified control plane with IP networks.
- D. They use a fixed size cell, as unit of transmission.

**10. What is a feature of the IPv6 addressing scheme?:**

- A. The whole address is assigned by a single authority..
- B. Addresses are distributed in order to make it easy to aggregate them in the backbone router forwarding tables.
- C. Multicast addresses are not used..
- D. Variable length addresses are used.

**11. What is a feature of stateless auto-configuration in IPv6?**

- A. It is based on DHCPv6 (Dynamic Host Configuration Protocol version 6)
- B. It uses a standard prefix followed by an host number 64 bit long, derived from the MAC address
- C. It is mandatory to have a router in the sub-network to get the network prefix (the most significant 64 bits) with a message of router solicitation.
- D. It is mandatory to have a router in the sub-network to get the network prefix (the most significant 64 bits) with a message of router advertisement.

**12. What is one of the possible uses of RTP (Real-time Transport Protocol) ?:**

- A. To carry a timestamp related to the block of samples transmitted in a packet
- B. To implement real-time application for industrial plant control.
- C. It can be used in multimedia applications to limit the packet transit time across the network
- D. It is possible to distinguish different streams (e.g. audio + video) addressed to the same host, by means of the field PT (Payload Type).

**13. Which function is performed by a voice gateway (or VoIP gateway) ?:**

- A. It forwards packets between the public internet and a corporate network.
- B. It translates packets carrying voice samples into signals understandable in a plain old telephone system (POTS)
- C. It encrypts voice signals arriving from a classical telephone network, before they are forwarded to internet, so that the signal cannot be understood by an eavesdropper.
- D. It translates SS #7 signalling into SIP signalling messages

**14. What is a feature of the SIP protocol?**

- A. It is only implemented in "softphones", that is software packages that are used for PC to PC calls.
- B. It is based on ASN.1, it is extremely complex and it is used for implementing signalling operations in IP networks.
- C. Often, It requires a server for each SIP domain.
- D. It is used to implement the transmission of voice streams over an IP network.

**15. What is the reason of diffusion of VoIP among domestic users?**

- A. The reduced cost associated to the possibility of VoIP technologies to compress voice channels, which require much less bandwidth than analog telephony, with a big reduction of bandwidth used in the backbone.
- B. The reduced costs caused by higher costs in maintaining an high quality channel (the twisted pair) that is more expensive than physical lines used for data transmission.
- C. Costs are often comparable with traditional telephony, but it is not necessary to pay an extra fee for each phone call, in addition to the flat rate tariff of the ADSL line.
- D. Quality of the calls are higher in VoIP, because the providers adopt suitable QoS mechanisms to offer high standards of quality for the phone calls.

**16. When it is necessary to design a new network for integrated data and voice traffic, which is the highest priority requirement to fulfil?:**

- E. Mechanism to achieve deterministic characteristics for the voice calls
- F. Mechanisms to reduce jitter as much as possible.
- G. Mechanisms to obtain transit time for the voice packets as short as possible
- H. Routing protocols to find alternative paths in order to avoid call interruption, in case of failure,

**17. What is a feature of the Session Initialization Protocol (SIP)?**

- E. It is necessary that the media stream is established with the help of server called Media relay.
- F. It is not scalable, because it does not specify how to find users in different domain than the caller.

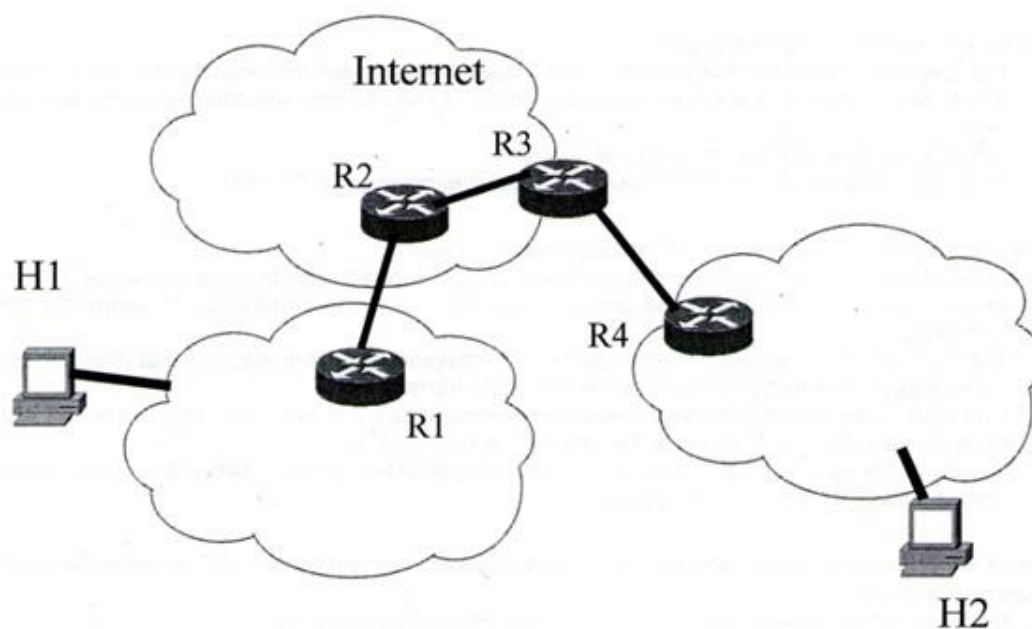
- G. It is necessary that User Agent is always associated to the same IP address
- H. It is possible to use a server to register a User Agent, so that the server know the mapping between the username and its current IP address.

**18. In a Frame Relay network, what is the Committed Information Rate?:**

- E. The maximum number of bits that can be sent to the network, in a specified time interval
- F. The minimum bandwidth guaranteed.
- G. The maximum length of a packet that can enter the network.
- H. The maximum transit time.

**Question with free-text answers**

19. In the network shown in the figure below, we want to set up an IPSec tunnel between R1 and R4. Indicate which operations are required. Once the tunnel is open, show the format (sender and received IP addresses) of the same packet travelling from H1 to H4, in the following places: between H1 and R1, between R2 and R3, between R4 and H4, The addresses to be used are: VPN addresses belong to the range 10.0.0.0/8; router addresses belong to the range 17.0.0.0/8, and each router has a different number in the second byte from the left.



20. Describe the stateless auto-configuration of IPv6, including the messages used to try to get possible prefixes from routers, and the information about the MAC addresses used.

21. Draw what is called the “SIP trapezoid” describing a call establishment sequence (INVITE), showing also the possible auxiliary messages used to complete the procedure, including possible registration messages,  
Note: It is possible to draw just a diagram without comments.