Lecture 4 – Routing Principles Quiz ANS

1. Why do we need routing protocols instead of using a full-mesh topology where every device connects directly to every other device?

A) Full-mesh topology uses less bandwidth
B) Full-mesh topology doesn't scale well; adding a new machine requires many new links
C) Routing protocols are always faster than direct connections
D) Full-mesh topology cannot handle packet loss

Answer: B

A full-mesh topology requires a link between every pair of machines. This scales poorly: adding one new machine requires connecting it to all existing machines. Routing protocols allow us to use fewer links while maintaining connectivity through routers.

2. What is the primary role of a router in a network?

A) To generate and send data packets
B) To receive and forward packets toward their destinations
C) To encrypt all network traffic
D) To replace the need for end hosts

Answer: B

Routers are intermediate machines that forward data packets along paths to their destinations. They don't originate or terminate the data themselves; they act as relay points.

3. How is a network typically modeled for routing purposes?

A) As a linear chain of computers
B) As a graph where edges represent links and nodes represent machines
C) As a single server with multiple clients
D) As concentric circles radiating from a central router

Answer: B

Network routing is modeled as a graph where each edge represents a link connecting exactly two machines, and each node represents a machine (router or end host) identified by a unique label.

4. What are the three main challenges that make routing a hard problem?

A) Packet size, transmission speed, and router cost
B) Changing topologies, distributed protocols, and best-effort links
C) Physical cable length, electrical interference, and signal attenuation
D) Multiple protocols, encryption standards, and authentication methods

Answer: B

The three core challenges are: (1) the network topology constantly changes as hosts join/leave and links fail, (2) routers don't have a global view of the network and must coordinate in a distributed manner, and (3) links are best-effort so packets can be dropped.

5. What is intra-domain routing?

A) Routing between different countries on the Internet
B) Routing within a single network (also called Interior Gateway Protocols or IGPs)
C) Routing used only by end hosts
D) Routing that doesn't require routers

Answer: B

Intra-domain routing computes routes within a single network. Each network can choose their own intra-domain protocol based on their size, capacity, and operational needs.

6. Which protocol has the Internet used for inter-domain routing since the 1990s?

A) OSPF
B) RIP
C) BGP (Border Gateway Protocol)
D) ISIS

Answer: C

BGP (Border Gateway Protocol) is an Exterior Gateway Protocol (EGP) that computes routes between networks. All networks on the Internet must agree on this protocol for inter-domain communication.

7. What is destination-based forwarding?

A) Forwarding packets only to their final destination without using routers
B) Each router uses a table mapping destinations to next hops; forwarding decisions depend only on the destination address
C) Forwarding packets based on the source address
D) Forwarding all packets to a central routing server

Answer: B

In destination-based forwarding, each router maintains a forwarding table that maps destination addresses to next hops. When a packet arrives, the router looks up the destination address and forwards it accordingly.

8. What is the difference between routing and forwarding?

A) There is no difference; the terms are interchangeable
B) Routing is local while forwarding is global
C) Routing is global (determines table contents via router communication); forwarding is local (looks up destination and sends packet)
D) Forwarding is global while routing is local

Answer: C

Forwarding is the local action of looking up a packet's destination in a table and sending it to the next hop. Routing is the global process where routers communicate to determine how to populate forwarding tables based on the network topology.

9. What makes a global routing state valid?

A) It uses the least-cost path to every destination
B) It encrypts all packets for security
C) It has no dead ends and no loops
D) It prioritizes packets from important sources

Answer: C

A valid routing state ensures packets can reach their destinations without getting stuck. Dead ends occur when a packet arrives at a router with no next hop (except at the destination). Loops occur when packets cycle between the same routers indefinitely.

10. What is a dead end in routing?

A) A packet reaching its destination
B) A packet arriving at a router with no forwarding entry for that destination
C) A router with no incoming links
D) A link that fails

Answer: B

A dead end occurs when a packet arrives at a router but there is no next hop entry in that router's forwarding table for the packet's destination (and it's not the destination itself). This causes the packet to be dropped.

11. What is a loop in routing?

A) A path that returns to the same destination
B) A packet cycling around the same set of routers infinitely
C) A backup link that reconnects to the same router
D) A router that sends packets back to the sender

Answer: B

In destination-based routing, if a packet enters a loop, it cycles through the same routers indefinitely because each router's forwarding decision depends only on the destination, not the path history. With positive link costs, a loop would never decrease and the packet can never escape.

12. What is least-cost routing?

A) Minimizing the financial cost of network equipment
B) Assigning costs to edges and finding paths with the lowest total cost to destinations
C) Using the cheapest routers available
D) Forwarding only low-cost packets through the network

Answer: B

In least-cost routing, each link is assigned a cost based on metrics the operator wants to minimize (e.g., latency, bandwidth constraints, reliability). Routers forward packets along the lowest-cost path to each destination.

13. What properties must link costs have in least-cost routing protocols?

A) They must be arbitrary real numbers
B) They must always be negative or zero
C) They must be positive integers and symmetrical
D) They must vary based on the time of day

Answer: C

Link costs must be positive integers (preventing loops, since traversing an edge always increases cost) and symmetrical (the cost from A to B equals the cost from B to A). These assumptions simplify routing protocols.

14. What is a direct route in a router's forwarding table?

A) A route that requires no forwarding decisions
B) A hard-coded entry for a destination the router is directly connected to
C) A route calculated by a routing protocol
D) A route that bypasses other routers

Answer: B

A direct route is a hard-coded forwarding table entry for a destination directly connected to the router. It's created when the operator configures the router and doesn't require any routing protocol to discover it.

15. What is a static route?

A) A route that never changes because the network topology is fixed
B) A hard-coded forwarding table entry for a destination (not necessarily directly connected)
C) A route that is automatically optimized by routers
D) A route used only during network initialization

Answer: B

A static route is a manually hard-coded forwarding table entry that never changes. Unlike direct routes, the router may not be directly connected to the destination. Static routes are often used by operators for specific forwarding policies that should remain constant regardless of what routing protocols discover.