Lecture 8. Inter-Domain Routing Quiz ANS

1. What is an Autonomous System (AS)?

A) A single router that operates independently
B) One or more local networks under a single administrative control
C) A collection of all networks in a country
D) A computer network without any external connections

ANS: B

An Autonomous System is one or more local networks all under a single administrative control. Each AS is assigned a unique AS number (ASN). Examples include universities, and major ISPs.

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2. What is the primary difference between inter-domain and intra-domain routing?

A) Inter-domain uses BGP while intra-domain uses IP
B) Intra-domain computes routes within a single network; inter-domain finds paths between networks
C) Inter-domain is faster than intra-domain routing
D) Intra-domain requires more routers than inter-domain

ANS: B

Inter-domain routing focuses on finding paths between different networks (ASes), while intra-domain routing computes routes within a single network. Inter-domain operates at the AS level where individual routers are abstracted away into a single node.

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3. What are the two main types of business relationships in the AS graph?

A) Customer-to-customer and peer-to-peer
B) Provider-to-provider and host-to-host
C) Customer-provider and peering relationships
D) Backup and primary relationships

ANS: C

The two main business relationships are: (1) Customer-provider: the customer pays the provider, who forwards traffic to/from the customer; and (2) Peering: peers don't pay each other and exchange roughly equal traffic.

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4. What does a Stub AS do?

A) Forwards packets on behalf of other ASes
B) Only sends and receives packets on behalf of its own hosts; does not forward between other ASes

C) Provides redundant connections to the backbone
D) Acts as a backup for failed routers

ANS: B

A Stub AS only sends and receives packets for its own internal hosts. It does not forward packets between other ASes. Most ASes are Stub ASes. Examples include Hofstra University and local banks.

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5. What are Transit ASes?

A) ASes that connect to only one other AS
B) Temporary ASes used during network upgrades
C) ASes that forward packets on behalf of other ASes; similar to routers in the intra-domain model
D) ASes used only for experimental routing

ANS: C

Transit ASes forward packets on behalf of other ASes, similar to how routers forward packets in an intra-domain network. They can vary in scale from regional to global. Examples include AT&T and Verizon.

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6. Why can't the AS graph have cycles?

A) Cycles cause packets to be lost
B) A cycle would mean an AS is paying itself, which doesn't make business sense
C) Cycles prevent packets from reaching their destination
D) The Internet cannot handle cyclic graphs

ANS: B

The AS graph must be acyclic because a cycle in customer-provider relationships would mean an AS is paying itself for service, which doesn't make economic sense. However, cycles of peering relationships are acceptable since peers don't pay each other.

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7. What are Tier 1 ASes?

A) ASes that are one hop away from the destination
B) ASes at the top of the hierarchy with no providers; they peer with each other to ensure global connectivity
C) The first ASes to be connected to the Internet
D) ASes that provide service only to customer ASes

ANS: B

Tier 1 ASes are at the top of the AS hierarchy. They have no providers (no incoming edges) and peer with each other to ensure the entire AS graph remains connected. There are approximately 20 Tier 1 ASes worldwide, including AT&T, Verizon, and NTT Communications.

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8. What are the three main goals of inter-domain routing design?

A) Speed, reliability, and low cost
B) Scalability, privacy, and autonomy
C) Redundancy, encryption, and traffic balancing
D) Bandwidth optimization, latency reduction, and packet prioritization

ANS: B

The three main goals are: (1) Scalability (routing must scale to the entire Internet using hierarchical IP addressing), (2) Privacy (ASes don't want to reveal sensitive information like who their providers are), and (3) Autonomy (ASes want freedom to choose their own policies based on business goals).

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9. What is the Gao-Rexford principle?

A) All ASes must use the same routing algorithm
B) ASes should prefer the shortest path to minimize latency
C) ASes prefer the most profitable path: customer > peer > provider
D) All paths must go through Tier 1 ASes

ANS: C

The Gao-Rexford principle reflects real-world business practices: making money is good and don't do work for free. ASes prefer paths where the next hop is a customer (they pay me) > peer (neutral) > provider (I have to pay). This is based on profitability rather than path length.

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10. According to Gao-Rexford rules, when will an AS participate in forwarding a packet?

A) Always, as long as the packet reaches its destination
B) Only if at least one of its neighbors along the path is a customer
C) Only if the path is the shortest
D) Only if the packet originates from a Tier 1 AS

ANS: B

An AS will only participate in a route if at least one of its two neighbors along the path is a customer. This ensures it gets paid for forwarding traffic. If both neighbors are peers or providers, the AS will not participate since it would work for free.

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11. What is a "valley-free" route?

A) A route that avoids mountainous terrain
B) A route that has no peering links
C) A route where you don't go downhill (to customers) and then back uphill go uphill (to a provider)
D) A route with the minimum number of hops

ANS: C

A valley-free route follows a specific pattern: it goes uphill (to providers), reaches a peak, optionally traverses one peering link, then goes strictly downhill (to customers). You cannot go downhill and then back uphill because that would mean paying to transit through a peer or provider, which violates profitability rules.

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12. What is BGP (Border Gateway Protocol)?

A) A protocol used only within a single network
B) The one and only inter-domain routing protocol used on the Internet
C) A replacement for IP addresses
D) A protocol for encrypting routing information

ANS: B

BGP is the Border Gateway Protocol and is the only inter-domain routing protocol on the Internet. Since all networks must cooperate at the AS level, everyone must agree on the same protocol. BGP extends distance-vector concepts to support policy-based routing.

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13. Why did BGP extend distance-vector instead of link-state routing?

A) Distance-vector is faster than link-state
B) Link-state requires revealing policies to all networks (no privacy) and all ASes must agree on the same metric (no autonomy)
C) Distance-vector uses less bandwidth
D) Link-state cannot handle failures

ANS: B

Link-state requires all routers to have a complete global view of the network, which means ASes would have to reveal their policies to everyone (no privacy) and all would need to agree on the same metric like least-cost (no autonomy). Distance-vector allows ASes to keep policies private while still converging on paths.

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14. What is the key difference between BGP import and export policy?

A) Import policy determines which paths to accept; export policy determines which paths to advertise to neighbors
B) Both determine the same thing but are applied at different times
C) Import policy applies to customers; export policy applies to providers
D) They are only used in Tier 1 ASes

ANS: A

Import policy determines which of the received route advertisements an AS will select as best and use for forwarding (customer > peer > provider). Export policy determines which of its routes the AS will advertise to each neighbor type. An AS exports customer routes to everyone, but peer/provider routes only to its customers.

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15. What is path-vector routing and why is it better than distance-vector for BGP?

A) Path-vector is just distance-vector with longer names
B) Path-vector includes the full AS path to the destination, enabling loop detection and arbitrary policy checking
C) Path-vector routes packets faster through fewer hops
D) Path-vector is only used for Tier 1 ASes

ANS: B

Path-vector routing advertises the entire AS path to a destination (e.g., "A → B → C → D") rather than just the distance. This solves two key problems: (1) Loop detection: if adding yourself to the path creates a cycle, reject it; and (2) Arbitrary policies: the complete path is available so ASes can check if the route satisfies their policies (e.g., "don't send through AS#X").

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16. True or False. iBGP is used for intradomain routing.

ANS: False, IGP, such as OSPF or RIP, is used for intradomain routing. iBGP is used to distribute externally learned routes internally.

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17. True or False. Avoiding loops is one reason why BGP uses path vector.

ANS: True, also helps ASes adopt certain policies.

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18. True or False. BGP always advertises the shortest path.

ANS: False, the path relies on other policies (like money) instead of purely distances.

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19. True or False. BGP route advertisements use Classless Inter Domain Routing (CIDR).

ANS: True.