Unit 1 · Computer Network and Communication

ANSWER KEY · FOR TEACHERS

Full marks 33

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. packets
2. bandwidth
3. throughput
4. latency
5. protocol
6. topology
7. repeater
8. full duplex

Each carries 0.5 mark. K · 4

2 Label the diagram

1. braided copper shield
2. glass cladding
3. copper core
4. glass core

Each carries 0.5 mark. K · 2

3 Multiple choice

i. **c.** fiber optic — K · 1

Fiber sends data as pulses of light through glass. DSL uses copper telephone wires, cable uses TV's coaxial cable, and satellite uses radio waves.

ii. **c.** repeater — K · 1

A repeater regenerates a weak signal and sends it on at full strength.

iii. **b.** half duplex — U · 1

Both can talk, so it isn't simplex, but only one at a time: half duplex. A phone call, where both talk at once, is full duplex.

iv. **b.** a switch — A · 1

A switch learns which port each device is on and sends the message only there. A hub would copy it to all twenty computers.

v. **b.** peer-to-peer — A · 1

With a few computers and nobody to run a server, peer-to-peer is cheap and simple: each computer shares its files and the printer directly. (A WAN is a size of network and a bus a shape, not an architecture.)

4 Match the columns

1. hub → **c.** copies whatever arrives to every other port
2. switch → **e.** sends each message only to the port it is meant for
3. router → **a.** joins different networks and chooses the best path by IP address
4. media converter → **b.** changes electrical signals from copper into light for a fiber

Each carries 0.5 mark. K · 2

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5 True or false

U · 3

i. ✓ **True**
ii. ✗ **False:** An IPv4 address is 32 bits long (four numbers of 8 bits); IPv6 addresses are 128 bits.
iii. ✓ **True**
iv. ✗ **False:** SMTP sends email; a browser asks for web pages with HTTP (or HTTPS).
v. ✓ **True**
vi. ✗ **False:** Bluetooth is for short distances, usually up to about 10 meters.

Each carries 0.5 mark.

6 Short answers

a. MARKING SCHEME — U · 2

✓ Bandwidth is the maximum data a connection can carry in a given time; throughput is the data actually transferred successfully in that time.
✓ Bandwidth is set by the line and the plan; throughput changes with sharing, lost packets and distance, and is never more than the bandwidth (or any other correct difference, such as an example of each).

b. MARKING SCHEME — U · 2

✓ Guided media send the signal along a wire or cable, on a fixed path (e.g. CAT6, coaxial cable, optical fiber); unguided media send it through the air or space, with no cable (e.g. Wi-Fi, Bluetooth, satellite).
✓ Guided media are hardly affected by weather and are harder to listen in to; unguided media are affected by walls, weather and distance, and are easier to listen in to (or any other correct difference).

c. MARKING SCHEME — A · 2

✓ Optical fiber cable, because copper Ethernet reaches only 100 m while fiber reaches kilometers (and isn't affected by electrical interference).
✓ A media converter (or a switch with a fiber port), to change the copper cable's electrical signals into light and back.

d. MARKING SCHEME — A · 2

✓ Leading zeros left off: 2001:db8:0:0:0:ff00:42:8329.
✓ The run of three zero groups written as a double colon: 2001:db8::ff00:42:8329.

7 Numerical problem

ANSWER — A · 3

i. 900 MB × 8 = 7,200 megabits. Time = 7,200 ÷ 20 = **360 seconds**, which is 6 minutes.
ii. 50 ÷ 5 = **10 Mbps** each, at most. 7,200 ÷ 10 = **720 seconds**, which is 12 minutes.

MARKING SCHEME

✓ The file changed to bits: 900 × 8 = 7,200 megabits.
✓ 7,200 ÷ 20 = 360 s (6 minutes).
✓ 50 ÷ 5 = 10 Mbps each, so 7,200 ÷ 10 = 720 s (12 minutes).

8 Long answer

ANSWER

A **star topology:** a 16-port **switch** in the middle of the lab, each of the **10 computers** joined to it by its own **CAT6** cable with RJ-45 plugs, a shared printer on the switch, and the switch joined to a **router**, which is joined to the ISP's fiber box (ONT).

- Star with a switch: a faulty cable or computer affects only itself and is easy to find; the switch sends each message only where it is going, so every computer gets full speed.

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- CAT6: 1 Gbps, cheap and reliable within a room (under 100 m). Spare ports leave room to grow.
- How they talk: the router gives each computer an IP address by DHCP. A computer printing sends packets to the printer's address and the switch delivers them only to the printer's port; a computer opening a website sends its packets to its default gateway, the router, which forwards them to the internet and sends the replies back.

A · 4

MARKING SCHEME

- ✓ A layout drawn or described: 10 computers each joined to one switch (a star), the switch joined to a router and the internet.
- ✓ A reason for the star and the switch: one fault affects only one computer and is easy to find, or the switch sends each message only to its destination.
- ✓ Suitable media named with a reason: CAT6 twisted pair cables with RJ-45 plugs (fast, cheap, under 100 m).
- ✓ How they communicate: addresses from DHCP; the switch delivers messages inside the lab; the router (default gateway) passes traffic to and from the internet.

9 Think

ANSWER

HA · 2

The central switch: every computer's only path to the others goes through it. Keep a spare switch ready to plug in (the cables need only be moved across), or split the lab between two switches joined together, so that one failure stops only half the lab.

MARKING SCHEME

- ✓ The central switch, since every message between computers passes through it.
- ✓ A sensible remedy: a spare switch kept ready, or two switches sharing the computers (or another workable answer).

10 Activity: Ask the network

(not marked)

WHAT STUDENTS SHOULD FIND

`ipconfig`: an IPv4 address such as 192.168.1.23 (private: 10.x, 172.16–31.x or 192.168.x), subnet mask 255.255.255.0, default gateway such as 192.168.1.1 (the router). `ping`: four replies with times in milliseconds and 0% loss when the connection works. `tracert`: about 6 to 15 hops, the first being the school's own router, the times growing as the path leaves Nepal. `nslookup`: one or more IPv4 and IPv6 addresses. If `ping 8.8.8.8` works but `ping google.com` doesn't, the network is fine and DNS is the problem.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	10	8	13	2	**33**

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