Question 1:
10.1.5.65 -> 0000 1010. 0000 0001. 0000 0101. 0100 0001

10.1.5.64/24 -> 0000 1010.0000 0001.0000 0101|.0000 0000
10.1.5.64/27 -> 0000 1010.0000 0001.0000 0101.010|0 0000
10.1.5.64/28 -> 0000 1010.0000 0001.0000 0101.0100 |0000
10.1.5.64/29 -> 0000 1010.0000 0001.0000 0101.0100 0|000

The router will send the packet to **10.1.3.3** via interface **s0**, as it matches the **longest prefix (10.1.5.64/29)** in the routing table.

Question 2:
131.23.151.76 -> 1000 0011. 0001 0111. 1001 0111. 0100 1100

131.16.0.0/12 -> 1000 0011.0001 0000.0000 0000.0000 0000

131.19.0.0/16 -> 1000 0011.0001 0011.0000 0000.0000 0000 //no match

131.22.0.0/15 -> 1000 0011.0001 0110.0000 0000.0000 0000

131.28.0.0/14 -> 1000 0011.0001 1100.0000 0000.0000 0000 //no match

Forwarded on 131.22.0.0/15 to output interface 1 as it is most specific and longest

Question 3:

192.24.14.32 - > 14 more closely matches .12.0/22

Question 4:

Layer 1: Application:

Provides services to end users. Handles high level protocols like http ensuring data is presented in a usable format.

Layer 2: Transport: Ensures reliable data transfer between devices. It manages end-to-end communication, error detection and retransmission. Key protocols here are TCP and UDP.

Layer 3: Internet: Manages local addressing, routing and packet forwarding. Ensures data can traverse different networks to reach it's final destination.

Layer 4 : Network : Handles physical addressing, frame transmissions and hardware interface.

The routers highest layer is the internet layer as it determines the best path for packets to go through to reach their destination. The highest layer for the switches

is the network layer examining MAC addresses for forwarding frames within a local network (LAN).

Question 5

Traceroute is a network diagnostic tool used to determine the path that packets take from a source to a destination across a network. Traceroute sends packets to the destination, the packet's TTL field is set to an initial value, starting at 1, a protocol is sent back to the sender whenever the packet arrives at a router. Traceroute increases the TTL value for each subsequent set of packets. This allows it to identify each hop along the path to the destination. It repeats the process until the destination is reached or a timeout occurs. It would be useful for diagnosing whenever a user is experiencing slow internet speed or an inability to connect to a specific server as trace routing can reveal the path packets take to reach the server, identify where delays or failures occur and show specific hops during the datas path.

Question 6

To handle multiple concurrent client connections I would use multithreading. Multithreading works by the server creating a new thread for every connection. Each thread handles communication with a specific client. Threads operate independently, allowing simultaneous processing of multiple connections. Some advantages of this method would be the simplicity of implementing it and having each thread run independently so logic handling is isolated. Some challenges may be a large thread overhead as each thread consumes memory and resources. High client volumes may also overwhelm the server due to thread limits. It is best to use multithreading when you need a moderate number of connections where simplicity is prioritised.