Below is a structured comparison of **Private vs. Public IP**, **IPv4 vs. IPv6**, and **TCP vs. UDP** in a format suitable for a PDF assignment. You can copy this content into a document and save it as a PDF.

Assignment 3: Networking Concepts Comparison

1. Private IP vs. Public IP

Aspect	**Private IP**	**Public IP**
Definition	An IP address used within a private network (e.g., home, office).	An IP address used to identify a device on the internet.
Scope	Not routable on the internet; only used internally.	Routable on the internet; globally unique.
Range	Reserved ranges:	Any IP address outside the private IP ranges.
	- IPv4: 10.0.0.0 to 10.255.255.255,	
	- 172.16.0.0 to 172.31.255.255,	
	- 192.168.0.0 to 192.168.255.255	
Usage	Used for internal communication within a network.	Used for communication over the internet.
Security	More secure as it is not directly exposed to the internet.	Less secure as it is exposed to the internet and vulnerable to attacks.

| **Example** | 192.168.1.1 | 203.0.113.45 |

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2. IPv4 vs. IPv6

Aspect	**IPv4**	**IPv6**
Address Length	32-bit address (4 bytes).	128-bit address (16 bytes).
Address Format	Decimal notation (e.g., 192.168.1.1).	Hexadecimal notation (e.g., 2001:0db8:85a3::8a2e:0370:7334).
Address Space	Limited: ~4.3 billion addresses.	Extremely large: 340 undecillion addresses.
Header Size	Fixed header size of 20 bytes.	Fixed header size of 40 bytes.
Security	Relies on additional protocols (e.g., IPSec) for security.	Built-in IPSec for encryption and authentication.
NAT (Network Address Translation)	Commonly used due to address scarcity.	Not required due to vast address space.
Example	192.168.1.1	2001:0db8:85a3:0000:0000:8a2e:0370:7334

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3. TCP vs. UDP

Aspect	TCP (Transmission Control Protocol)	UDP (User Datagram Protocol)
Connection	Connection-oriented protocol (establishes a connection before data transfer).	Connectionless protocol (no connection establishment).
Reliability	Reliable; ensures data delivery and retransmits lost packets.	Unreliable; no guarantee of data delivery or retransmission.
Ordering	Ensures data packets are delivered in order.	No ordering; packets may arrive out of order.
Speed	Slower due to connection setup and error checking.	Faster due to minimal overhead.
Error Checking	Extensive error checking and correction.	Basic error checking (checksum only).
Use Cases	Used for applications requiring reliability (e.g., web browsing, email).	Used for real-time applications (e.g., video streaming, online gaming).
Example Protocols	HTTP, HTTPS, FTP, SMTP	DNS, DHCP, VoIP, TFTP