## CS & IT ENGINEERING



Application layer protocol

**Lecture No-03** 



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## TOPICS TO BE COVERED

Application layer Protocols Part-3



# APPLICATION LAYER PROTOCOL

WWW. google.com 74.125.239.35



## Domain Name System (DNS)



- 1. Easy to remember the domain names
- IP addresses are not static
- 3. DNS is a protocol used to convert domain name to IP addresses



#### Domain Name System (DNS)

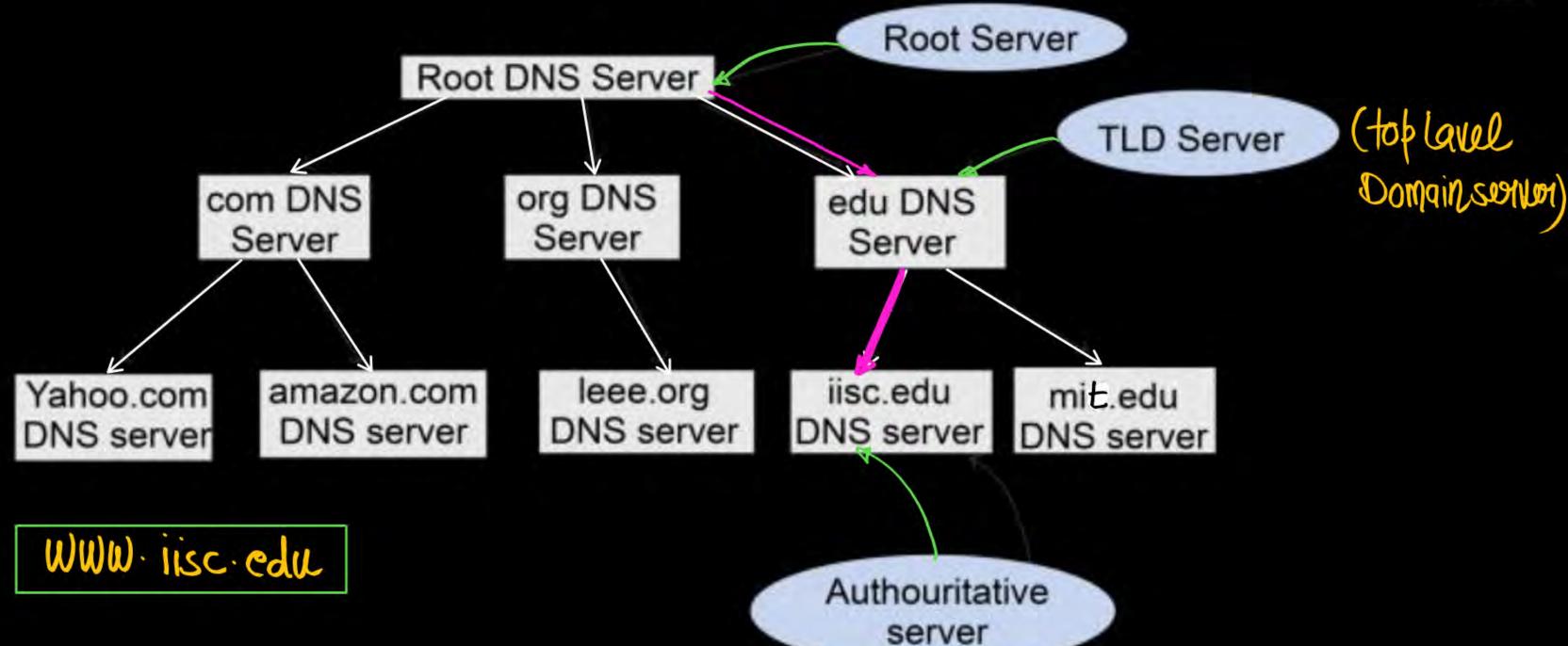
Most commonly used domain are:

- com usually used by commercial organization eg: Yahoo(yahoo.com)
- (ii) edu usually used by educational institute eq: iisc.edu
- (iii) org used by Non profit organization eg: ieee.org
- (iv) mil used by Military organization
- (v) net It is open public for any commercial organization
- (vi) gov used to represent government organization eg: isro.gov

## Country Domain

- · US
- ·UK
- · M

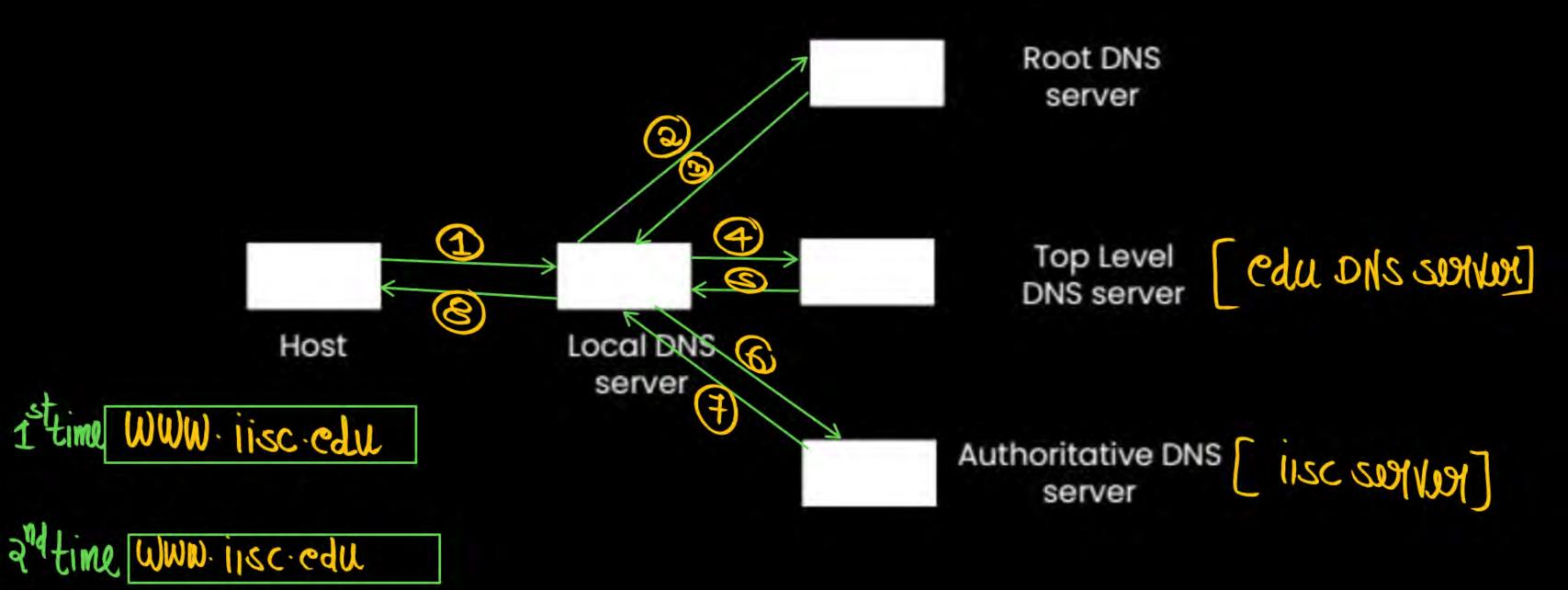




**Iterative Queries** 

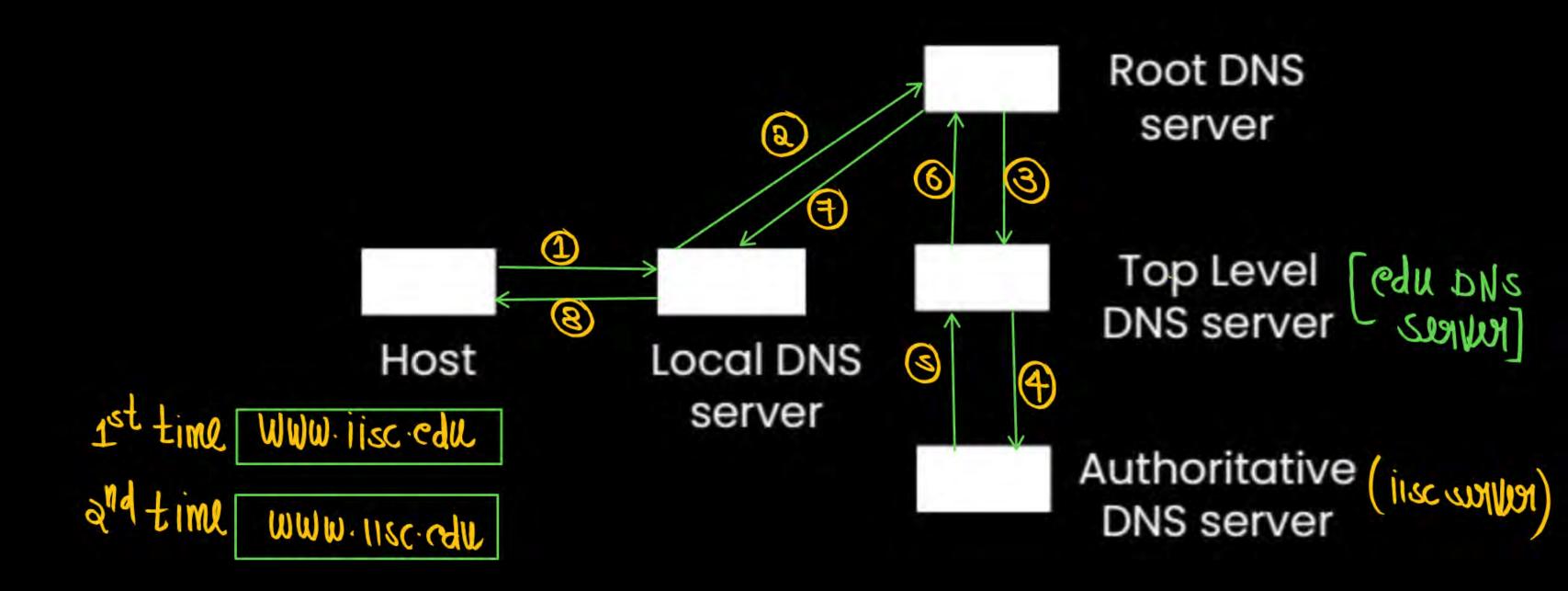
## DNS USE UDP -- PortNO-53





## **Recursive Queries**





#### Root DNS Server



Root name servers play a key role in resolving any DNS query. There are 13 root name servers worldwide. If a situation arises that the entire 13 root name servers are unreachable, the Internet would fail. Usually a host sends a query to its nearest root name server. If any one of these servers fails the requests are diverted to another nearest server.

**E.g.** if you are in India the nearest root name server is at Tokyo. If the root name server at Tokyo is down, all the DNS queries or traffic is diverted to server at Europe, which is the next nearest server to India.

## NOTE:



- By default DNS uses UDP at transport layer.
- DNS can use either UDP or TCP.
- In both cases the well known port number used by the server is port number-53.
- 1. DNS query size < 512 byte ---- UDP
- 5. DNS query size>512 byte ----> TCP



Consider the resolution of the domain name www.gate.org.in by a DNS resolver. Assume that no resource records are cached anywhere across the DNS servers and that iterative query mechanism is used in the resolution. The number of DNS query-response pairs involved in completely resolving the domain name is \_\_\_\_\_.

ANS: 4

Q.

(GATE 2022)

## File Transfer protocol (FTP)



- File transfer protocol is a <u>standard internet protocol for transferring files b/w</u> computers over TCP/IP connection.
- It uses port number 20 & 21 on TCP.
- 3. It has two types of connection
  - (i) Control connection (port number. 21)
  - (ii) Data connection (port number 20)
- Control connection remains connected during the entire interactive FTP session.
- The data connection is opened and closed for each file transfer activity.

## File Transfer protocol (FTP)



- 6. When user starts an FTP session, the control connection opens. While the control connection is open, the data connection can be opened and closed multiple times if several files are transferred.
- FTP uses persistent TCP connections for control information.
- 8. FTP uses Non-persistent TCP connections for data information.
- FTP is a connection-oriented protocol.
- 10. FTP is an "out of band" protocol as data and control information flow over different connection.

## File Transfer protocol (FTP)



- 11. Some protocols send their request and data in the same TCP connection for this reason they are called as In-band protocol.
- 12. HTTP & SMTP are In-Band protocol.
- 13. FTP is state full protocol.

#### Transmission mode:



FTP can transfer a file across the data connection using one of the following three transmission modes.

1/Stream mode

2. Block mode

Compressed mode

Stream mode: It is a default mode, data are delivered from FTP to TCP as a continuous stream of bytes.

Block mode: In block mode, data can be delivered from FTP to TCP in blocks. In this case, each block is preceded by a 3 byte header. The first byte is called the block descriptor, the next two byte define the size of block in bytes.

Compressed mode: In compressed mode, if the file is big, the data can be compressed. In the text file this is usually spaces (blanks). In binary file, null character are usually compressed.

## File Type



FTP can transfer one of the following file types across the data connection:

- (i) ASCII file
- (ii) EBCDIC file (File format used by IBM)
  - (ii) Image file

#### Data structure:



FTP can transfer a file across the data connection using one of the following interpretation of the structure of the data:

- File structure
- 2. Record structure
- Page structure

File Structure: It is used by default. It is a continuous stream of bytes.

Record Structure: In the record structure, the file is divided into records. This can be used only with the text file.

Page Structure: In the page structure, the file is divided into pages, with each page having a page number and page header. The page can be stored and accessed randomly or sequentially.

#### Command in FTP



**USER:** User information

PASS: Password

**ACCT**: Supplies accounting information

CWD: Change to another directory

REIN: Remove all authentication information and parameter settings.

QUIT: Log out of the system

PORT: Client chooses a port

PASV: server chooses a port

TYPE: Default file type (A: ASCII, E: EBCDIC, I: Images)

MODE: Data transmission mode (S: stream ,B: Block , C: Compressed)

PROMPT: Turn on (or turn off) file transfer prompting

STRU: Define data organization (F: file, R: record, P: page)

#### **HTTP Protocol**



- HTTP protocol used mainly to access data on word wide web (www)
- 2. It is client server protocol using port No 80 on TCP
- HTTP is "In-Band" protocol i.e. bath request and data we will send only in one connection.
- HTTP is a stateless protocol i.e. It does not maintain any information of user.
- 5. There are two types of HTTP protocol
  - () Non persistent (1.0)
  - (II) Persistent (1.1)

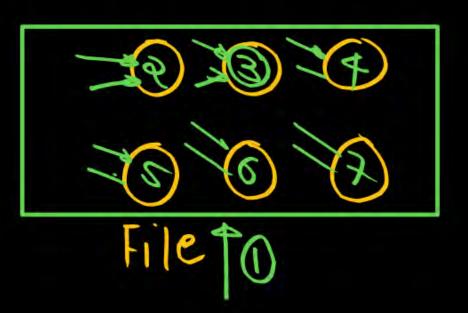
### Non persistent(1.0)



In a Non persistent connection one TCP connection is made for each request/response. This strategy follow the following steps:-

- The client opens a TCP connection and sends a request.
- (ii) Server sends the response and closes the connection.
- (iii) In this strategy, If a file contains link to N-different pictures in different files(all located on same server) the connection must be opened and closed

N+1 times.



## Persistent (1.1)



- In a persistent connection the server leaves the connection open for more request after sending a response.
- The server closes the connection at the request of client or time out has been reached.

#### **HTTP Commands**



GET-Request a document from server

HEAD-Request information about a document but not the document itself

PUT-Send a document from client to server

POST-Send some information from client to server

TRACE-It is used for debugging

**DELETE-Delete the web page** 

CONNECT-It is not currently used. It is reserved for future purpose

**OPTIONS-Inquires about available options** 

## Important table



Application	Port Number.	Transport Protocol
DNS	> 53	UDP
HTTP	80	TCP
FTP	> 20 (Data connection) > 21(Control connection)	TCP
SMTP	<del>-</del> 25 <del>-</del>	TCP
POP	110	TCP
SNMP	161, 162	UDP
TFTP	69	UDP
IMAP	143	TCP
Telnet	23	TCP
DHCP	67 (DHCP Server) 68 (DHCP Client)	UDP

## Q.1 Which one of the following uses UDP as the transport protocol?

(GATE-2007)

A. HTTP

B. Telnet

C. DNS

D. SMTP

TCP	UDP
SMIP	DNS
FTP	SNMP
HTTP	DHCP
IMAP	TFTP
POP	All seal time and
Telnut	
	Multimedia Protocols



## Q.2 Which of the following transport layer protocols in used to support electronic mail?

(GATE-2012)

A. SMTP

B. IP

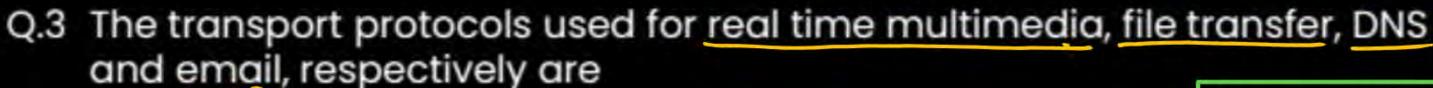
C. TCP

D. UDP

UDP

TCP

PAY



(GATE - 2013)

A. TCP, UDP, UDP and TCP

B. UDP, TCP, TCP and UDP

C. UDP, TCP, UDP and TCP

D. TCP, UDP, TCP and UDP

#### Match the following:



	List 1: (Protocols)		List2: (Port number)
(P)	DNS	1)	23
(Q)	DHCP (	2)	53
(R)	IMAP (	3)	67
(S)	POP3	4)	68
	X	5)	110
	X	6)	143

#### Codes:

#### Q.5 Match the following:



#### Application layer protocols

Port No.

#### Codes:

## Important table



SHORT TRICK	DNS	HTTP	SMTP	POP	IMAP	FTP
Stateful/ Stateless	Stateless	Stateless	Stateless	Stateful	Stateful	Stateful
Transport Protocol Used	UDP	TCP	TCP	TCP	TCP	TCP
Connectionless/ Connection oriented	Connection less	Connection less	Connection oriented	Connection oriented	Connection oriented	Connection oriented
Persistent/Non- persistent	Non- persistent	HTTP 1.0 is non persistent HTTP 1.1 is persistent.	Persistent	Persistent	Persistent	Control connection is persistent. Data connection is non-persistent.
Push/Pull			Push	Pull	Pull	Can't
Port Number Used	53	80	25	110	143	20 for data connection. 21 for control connection.
In band/ Out-of-band	In band	In band	In band	In band	In band	Out-of- band

## Q.6 Which of the following is / are example(s) of statefull application layer protocols?



(GATE 2016)

HTTP FTP TCP POP3

A. (i) and (ii) only

B. (ii) and (iii) only

C. (ii) and (iv) only

D. (iv) only

Stateless	stateFul
DNS	POP
HTTP	IMAP
SMTP	FTP

Q.7 Which of the following protocol pairs can be used to send and retrieve emails (in that order?)

(GATE 2019)

MAP, SMTP

B. SMTP, POP3

C. IMAP, POP3

D. SMTP, MIME

## Q.8 The protocol(s) that uses a connectionless UDP.



- A. SMTP
- B. POP3
- C./FTP
- D. DNS

Q.9 In one of the pairs of protocols given below, both the protocols can use multiple TCP connections between the same client and the server. Which one is that?

A. HTTP, FTP

B. HTTP, TELNET

C. FTP, SMTP

HTTP, SMTP

(GATE 2015)

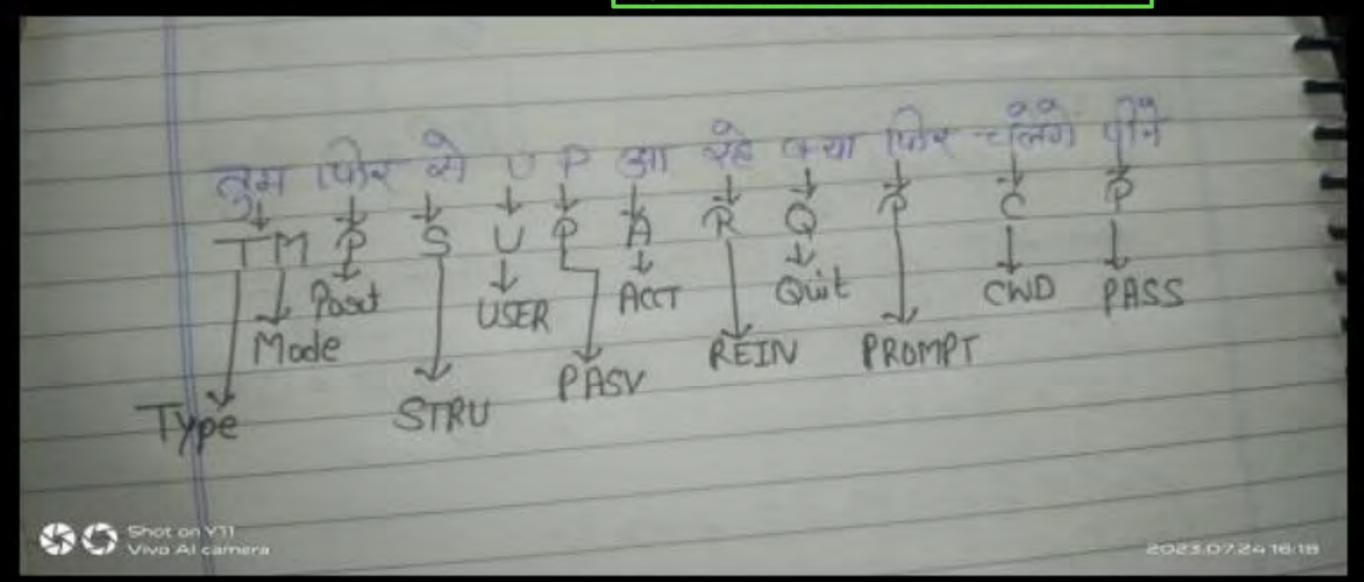
## Commands



HTTP	FTP	SMTP
GET	USER	HELO
HEAD	PASS	MAIL FROM
PUT	ACCT	RCPT TO
POST	CWD	DATA
TRACE	REIN	QUIT
DELETE	QUIT	RSET
CONNECT	PORT*	VRFY
OPTIONS	PASV	NOOP
	TYPE	TURN
	MODE	EXPN
	PROMPT	HELP
	STRU	SEND FROM
		SMOL FROM
		SMAL FROM

## FTP Command shootcut







## FTP HTTP SMTP

Q.10 Consider the three commands: PROMPT, HEAD and RCPT. Which of the following options indicate a correct association of these commands with protocols where there are used?

(GATE 2005)

A. HTTP, SMTP, FTP

B. FTP, HTTP, SMTP

C. HTTP, FFP, SMTP

D. SMTP, HTTP, FTP

SMTP FTP



#### Q.11 HELO and PORT, respectively, are commands from the protocols

(GATE 2016 IT)

- A. FTP and HTTP
- B. TELNET and POP3
- C, HTTP and TELNET
- D. SMTP and FTP



Q.12 Identify the correct sequence in which the following packets are transmitted on the network-by a host when a browser requests a webpage from a remote server, assuming that the host has just been restarted.

(GATE 2016)

A. HTTP GET request, DNS query, TCP SYN

B. DNS query, HTTP GET request, TCP SYN

C. DNS query, TCP SYN, HTTP GET request

D. TCP SYN, DNS query, HTTP GET request

Www. Physics Wallah.com

#### Q.13 Which one of the following is not a HTTP "request method"?



- A. PUT
- B. GET
- C. SEND
  - D. HEAD

## Q.14 Identify HTTP command



- A. REIN
- B. PASU
- C. CWD
- D. POST

#### Q.15 Match the following:



HTTP

Uses both TCP and UDP

2. FTP-Vis

Uses two ports for its operation

3. DNS \ iii.-

iii. MIME to deal with non ASCII data

4. SMTP

Used to get the mail

5. POP3 V.

TRACE method loop back request message

A. 1-i, 2-ii, 3-iii, 4-iv, 5-iv

B. 1-i, 2-iii, 3-ii, 4-v, 5-iv

C. J-iv, 2-ii, 3-iii, 4-i, 5-v

Ø. 1-v, 2-ii, 3-i, 4-iii, 5-iv



Q.16 Assume that you have made a request for a web page through your web browser to a web server. Initially the browser cache is empty. Further, the browser is configured to send HTTP requests in non-persistent mode. The web page contains text and five very small images. The minimum number of TCP connections required to display the web page completely in your browser is \_\_\_\_\_\_6\_\_\_.

(GATE CS 2020)

