

作答前請務必詳閱下列規定：

1. 除作答需要使用的文具之外，其他物品請放到教室前方，特別是手機與平板電腦等手持裝置，嚴禁帶在身上或是放置在座位上，並請關機或切換至震動模式；否則視為違反考試規則，並視嚴重程度扣分。
2. 請記得於簽到表上簽名後再離開考場。
3. 考試結束請繳回此試卷。
4. 若使用超過一張答案紙，各頁均須寫上學號與姓名，並於右下角標示頁碼，使用教室前方提供的釘書機裝釘後再交卷。

1. (10%) Fill in the blanks with the most appropriate term listed below:

physical layer, link layer, network layer, transport layer, session layer, presentation layer, application layer, SMTP, IMAP, POP3, TCP, UDP, packet switching, circuit switching, viruses, worms

- (a) _____ is an Internet standard for electronic mail transmission. It transfers messages from senders' mail servers to the recipients' mail servers.
 - (b) _____ is a transport layer protocol, and provides a connection-oriented service to its applications.
 - (c) Routing protocols are _____ protocols that are responsible for exchanging information between routers so that the routers can select the proper path for network traffic.
 - (d) _____ is a mail access protocol and does not provide any means for a user to create remote folders and assign messages to folders.
 - (e) _____ is a transport layer protocol, and provides flow control and congestion control.
2. (10%) Answer true or false for each of the following statements:
- (a) A user requests a Web page that consists of some text and three images. For this page, the client will send one request message and receive four response messages.
 - (b) Most packet switches use store-and-forward transmission at the inputs to the links. Store-and-forward means that the packet switch must receive the entire packet before it can begin to transmit the first bit of the packet onto the outbound link.
 - (c) Worms are malware that require some form of user interaction to infect the user's device. 病毒提
 - (d) With nonpersistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
 - (e) One important characteristic of cable Internet access is that it is a shared broadband medium.
3. (5%) Explain why peer-to-peer architectures provide better scalability than client-service architectures.

4. (15%) Explain the following terms:
 - (a) botnet
 - (b) denial-of-service attack
 - (c) torrent
 - (d) forwarding table
 - (e) DNS poisoning attack
5. (10%) Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay, and briefly explain each of them. Which of these delays are constant and which are variable? Note that the network may be congested.
6. (10%) Suppose users share a 1000 Mbps link. Also suppose each user requires 2 Mbps when transmitting, but each user transmits only 10 percent of the time.
 - (a) (3%) When circuit switching is used, how many users can be supported?
 - (b) (3%) For the remainder of this problem, suppose packet switching is used and there are 1000 users. Find the probability that at any given time, exactly n users are transmitting simultaneously.
 - (c) (4%) Find the probability that there are 500 or more users transmitting simultaneously.
7. (4%) List at least two advantages of packet switching compared with circuit switching.
8. (6%) In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages into smaller packets and sends the packets into the network.
 - (a) (3%) What are reasons to use message segmentation?
 - (b) (3%) What are the drawbacks of message segmentation?
9. (10%) The following figure shows the output after executing an nslookup command in Windows.

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Microsoft Windows [版本 6.1.7601]
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C:\Users\jason>nslookup www.google.com
伺服器:  cguaplo.cgu.edu.tw
Address:  163.25.114.1

未經授權的回答:
名稱:    www.google.com
Addresses:  2404:6800:4008:802::2004
           74.125.203.105
           74.125.203.106
           74.125.203.147
           74.125.203.99
           74.125.203.103
           74.125.203.104

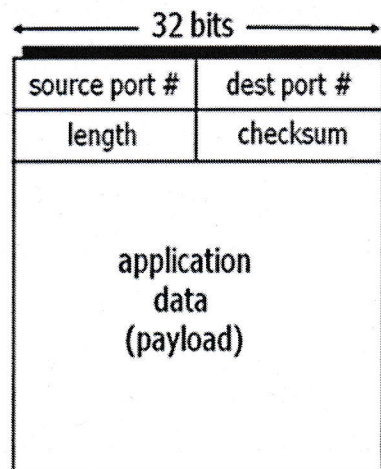
C:\Users\jason>
  
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- (a) (5%) Why does the DNS server return a list of IP addresses?
- (b) (5%) The output contains “未經授權的回答”. What does that mean? How can we get a DNS reply without “未經授權的回答”?

10. (10%) Why are web caches (also called proxy servers) required in a network? Give an example to explain how a web cache work.
11. (10%) UDP (User Datagram Protocol) does not provide reliable data transfer. Give at least two reasons why an application developer might choose to run an application over UDP rather than TCP (Transmission Control Protocol).
12. (10%) The following figure shows the UDP segment structure. Suppose that the source IP address is 120.126.16.119, the destination IP address is 64.233.189.104, the source port number is 9487, the destination port number is 8787, and the application data is "pikachu". What is the value of the checksum field? Note that you have to show how you get the answer.

Hint: The ASCII value of 'a' is 0x61. UDP pseudo header contains the following fields:

- The source IP address (4 bytes)
- The destination IP address (4 bytes)
- The IP protocol (2 bytes) (UDP is 17)
- The UDP length (2 bytes)



UDP segment format

a 61
b 62
c 63
d 64
e 65
f 66
g 67
h 68
i 69
j 6A
k 6B
l 6C
m 6D
n 6E
o 6F
p 70
q 71
r 72
s 73
t 74
u 75
v