

# Practice Final Exam

**Due** No due date

**Points** 60

**Questions** 20

**Time Limit** 195 Minutes

**Allowed Attempts** Unlimited

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## Instructions

**This is a practice for final exam, and the instruction below will be used for the official exam on 13/11/2020. Please read it carefully.**

### The University of Melbourne School of Computing and Information Systems

### COMP90007 Internet Technologies Practice Exam Semester 2, 2020

**Reading Time:** 15 minutes

**Total Time:** 3 hours 15 minutes (including reading time)

#### Instructions to Students:

The exam includes XX questions worth a total of 60 marks, making up 60% of the total assessment for the subject.

- Please answer all questions in the fields provided using English. No handwritten answers, images or files allowed.
- The value beside the Question number displays the marks allocated to each question.
- This is a timed quiz. The time remaining is shown in the quiz window and will continue to count down even if you leave the Canvas site.
- It is recommended that you do not close your browser while working on this quiz.
- At the end of the time limit, your answers will be submitted automatically.
- Partial marks will be available. No question requires writing lengthy answers. Please be clear and brief as you may lose points for unclear or redundant descriptions.

**Authorised Materials:** This exam is open-book. The work you submit ***must be based on your own knowledge and skills, without assistance from any other person.***

While undertaking this exam you ***are permitted to:***


- make use of textbooks, lecture slides (including electronic versions), lecture recordings and material provided as part of tutorials in this subject.
- make use of your own personal notes.
- use calculators or mathematical software to compute numeric answers.
- make use of other materials with proper references.

**IMPORTANT!! Collusion, Plagiarism, Copying are not allowed under any circumstances.**


- **Collusion** includes, but is not limited to, talking to, phoning, emailing, texting or using the internet to communicate with other students. Similarly, you cannot communicate with any other person via any means about the content of this exam during the examination time. If another student contacts you during the examination period, please inform the subject coordinator immediately.
- Your answers to the exam **must be in your own words** and not directly copied from lecture notes, tutorial materials, the Internet or joint study notes you have prepared with your friends. You may refer to sources, but answers should be written in your own words.
- Any similarity detected between your answers, the answers from other students and/or from the Internet or other sources will be investigated and may result in severe penalties.


### Exam support [updated 9/11/2020]

**During the exam**, if you have questions about the exam content, please use Exam Support chat tool to have one-to-one communication with the subject coordinator (using text, no audio).

More details about the Exam Support chat is at : <https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/support-services>   
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Technical support for this exam can be accessed at:

<https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/technical-support>  [\\_ \(https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/technical-support\)](https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/technical-support)

Additional information about Canvas Quizzes, including troubleshooting tips, can be found [here](#)   
[\\_ \(https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/exam-types\)](https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/exams/exam-types) (scroll down to the Canvas Quiz section).

[Take the Quiz Again](#)

## Attempt History

Attempt	Time	Score
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	Attempt	Time	Score
LATEST	<a href="#">Attempt 1</a>	195 minutes	0 out of 60 *

\* Some questions not yet graded

Submitted Nov 12 at 14:21

### Question 1

Not yet graded / 3 pts

Briefly describe the key principles of OSI layer division ?

Your Answer:

A layer needs to be created when a different abstraction is needed and should perform a well-defined function.

Layer boundaries should be chosen to minimize the information flow across the interfaces.

The number of layers needed to be well designed to handle enough distinct functions and remain a wieldy architecture.

The function of each layer should be chosen with consideration of defining Internationally standardized protocols

A layer should be created where a different abstraction is needed. Each layer should perform a well-defined function. The function of each layer should be chosen with a view toward defining internationally standardised protocols. The layer boundaries should be chosen to minimise the information flow across the interfaces. The number of layers should be large enough that distinct functions need not to be thrown together in the same layer out of necessity, and small enough that the architecture does not become unwieldy.

## Question 2

Not yet graded / 3 pts

Briefly explain key advantages and disadvantages of using Fibre Optics versus Copper Wire.

Your Answer:

Pros

- + Support High data rates over a long distance
- + easy to maintain a fixed data rate over point-to-point links

Cons

- expensive and installation can be difficult in rural area
- is not readily support mobility or broadcast

Fibre is efficient to run over longer distances, has higher bandwidth and low noise, is difficult to tape; however it is expensive, requires specialists to deploy, and is fragile.

Copper Wire is cheaper, no specialist skill required, but it has lower bandwidth and is more receptive to noise.

## Question 3

Not yet graded / 4 pts

(1) How can you increase the bit rate of a 1200KHz line from X bit/s to 3X bit/s without changing the frequency?

(2) Consider a telephone line that is bandwidth limited to 4kHz. If we use 32 levels, what is the bit rate achieved to transmit data?

Your Answer:

Not known

(1) Increase the number of bits per symbol from A bit/symbol to  $3 \times A$  bits/symbol, for example, by increasing from a two-level code to a 8-level code.

(2)  $2 \times 4 \times \log_2 32 = 40\text{kbps}$

#### Question 4

Not yet graded / 2 pts

(1) The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the lectures is to be applied:

A B ESC D FLAG FLAG ESC C

Show the output data stream after the byte-stuffing algorithm has been applied.

(2) What is the maximum overhead in the byte-stuffing algorithm in general and when does it occur?

Your Answer:

(1)

A B ESC ESC D ESC FLAG ESC FLAG ESC ESC C

(2)

Suppose the size of a message is N

The maximum overhead is  $N + 2$

This happens when the original message only has FLAG and ESC data. For example

origin: FLAG ESC FLAG ESC

after byte-stuffing: FLAG ESC FLAG ESC ESC ESC FLAG ESC ESC FLAG

(1) A B ESC ESC D ESC FLAG ESC FLAG ESC ESC C

(2) 100% when the payload consists of only ESC and FLAG bytes.

Note: it is also correct if your answer is 50%, which is computed as  $\text{overhead} / \text{total length}$ . The sample solution 100% is computed as  $\text{overhead} / \text{payload}$ .

### Question 5

Not yet graded / 2 pts

Briefly explain the difference in operation and philosophy of two approaches to error handling on the data link layer, error-correcting and error-detecting.

Your Answer:

Error-correcting needs to find the error and correct it while error-detecting only has to check whether there is an error. Error-correcting is more efficient in noisy transmission media and error-detecting is more efficient in transmission media where low error rates occur.

Error correcting: Include enough information in frames to allow reconstruction/deduction of original content.

Error-detecting: Include enough redundancy to allow receiver to determine an error occurred and request retransmission.

### Question 6

Not yet graded / 2 pts

If a LAN is under high load, would it be more efficient to use a contention protocol or a collision free protocol in the MAC sublayer? Briefly explain your answer.

Your Answer:

It will be more efficient to use collision free protocol. Under high load, there will be higher number of collision. And if we use contention protocol, the contention process will cost lots of time and overhead.

Under high load a contention protocol would cause many collisions and not be effective, where a collision free protocol allows each source to use the network in turn. Therefore a collision free protocol should be used.

### Question 7

Not yet graded / 3 pts

Give the name of one sliding window protocols and briefly explain how that protocol works at Data Link Layer when a transmission error occurs.

Your Answer:

GO-BACK-N

for example, suppose A is sending to B and the second packages is lost, A will keep sending B packages 3, 4, 5... but B will discard all those package. And when time out, A will restart to send the package 2 since it only got ACK 1.

Selective Repeat: if an error occurs, the receiver will send negative acknowledgement to the sender, and keep the frames after the error in the buffer. Once the sender receives nak, it will retransmit that frame, and the receiver will send a cumulative acknowledgement of all the frames including the retransmitted one.

Similarly, you can choose to describe the process of Go-Back-N protocol.

**Question 8****Not yet graded / 4 pts**

A router has built the following routing table. The router can directly deliver packets over Interface 0 and Interface 1 or it can forward to routers R2, R3 and R4.

Start	Subnet Mask	Next Hop
148.96.39.0	255.255.255.0	Interface 0
148.96.39.128	255.255.255.128	Interface 1
148.96.40.0	255.255.255.128	R2
196.4.153.0	255.255.255.192	R3
default		R4

Describe what the router does if a packet addressed to each of the following destinations is received.

- (1) 148.96.40.12
- (2) 148.96.39.193

Your Answer:

128 = 1000 0000

193 = 1100 0001

(1)

send the package to R2

(2)

send the package to Interface 1



(1) 148.96.40.12 -forwards to R2.

(2) 148.96.39.193 matches to the first two entries, so it chooses the longest match and forwards the packet to Interface 1.

### Question 9

Not yet graded / 2 pts

What are the main purposes of subnetting? Briefly explain your answer.

Your Answer:

- allow networks to be split into several parts for internal uses while acting as a single network for external use
- reduce the number of address a router need to store in its routing table.

Subnetting allows networks to be split into several parts for internal uses whilst acting like a single network for external use. For external users, their routing tables do not have to store addresses for each host, which can avoid routing table explosion.

### Question 10

Not yet graded / 3 pts

With respect to routing packets in the Network Layer, explain the difference between a connectionless and connection-oriented service?

Your Answer:

packets can be routed independently to destinations in connectionless service while connection-oriented required packets travelling between destinations following the same route.

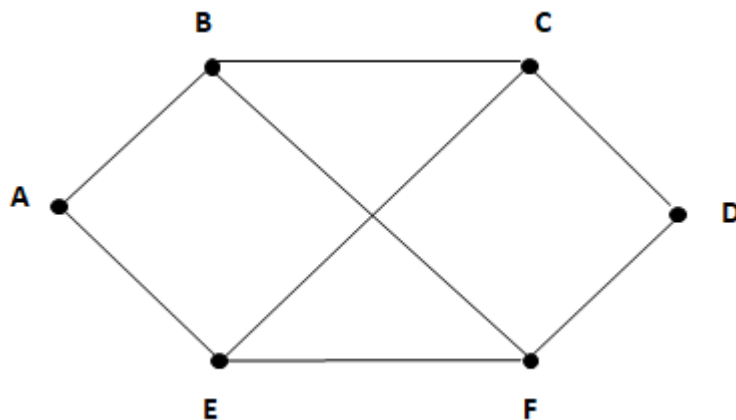
Connectionless: packets are injected into the network individually and routed independently of each other. No setup is needed in advance.

Connection-oriented: If connection-oriented service is used, a path from the source router all the way to the destination router must be established before any data packets can be sent. This connection is called a virtual circuit.

### Question 11

Not yet graded / 6 pts

Distance vector routing is used for a network of six nodes as shown below.



The following vectors have just come into router C from B: (5, 0, 7, 11, 10, 7); from D: (15, 11, 4, 0, 10, 11); and from E: (5, 10, 6, 10, 0, 3). Each vector contains the distances from a certain node to the other nodes, in the order of (A, B, C, D, E, F). The distances from C to B, D, and E, are 7, 4, and 6, respectively.

What is the new vector for C? Show a table of the outgoing lines to use and the expected distances from C to all the other nodes.

Your Answer:

To	B	D	E		NEW estimated	Line

					delay from C	
A	5	15	5		11	E
B	0	11	10		7	B
C	7	4	6		0	-
D	11	0	10		4	D
E	10	10	0		6	E
F	7	11	3		9	E
	CB delay	CD delay	CE delay			
	7	4	6			

So, the table of the outgoing lines to use and the expected distances from C to all the other nodes:

expected distances	Line
11	E
7	B
0	-
4	D
6	E
9	E

The outgoing lines and expected distances from C to the other nodes are:

	Outgoing	Distances
A	E	11
B	B	7
C	-	0
D	D	4
E	E	6
F	E	9

### Question 12

Not yet graded / 3 pts

A common approach to removing jitter in streaming audio is to buffer incoming packets at the receiver. Briefly explain a key problem using this approach for video conferencing.

Your Answer:

A key problem is the buffer size. Small buffer size can make the video susceptible to jitter and delay while a large buffer size will result in a delay at the start of playback.

Videoconferencing is a 2-way interactive service. Buffering introduces delay into the service, which is a nuisance for interactive services.

### Question 13

Not yet graded / 2 pts

Name two services that DNS provides.

Your Answer:

1. Address translation: hostname to IP
2. host aliasing

Services:

Hostname to IP address translation

Load Balancing

#### Question 14

Not yet graded / 3 pts

An encrypted file needs to be accessed in non-sequential order. Which cipher mode is best suited to encrypting this file, and briefly explain why.

Your Answer:

Stream Cipher Mode

Because in stream cipher mode, recursive sequential block encryption is used as a one-time pad, which is independent of the data. With the one-time pad, we can decrypt the ciphertext anywhere we want.

Counter mode is the best option, since each block can be encrypted or decrypted based on its location in the files using a counter. Other techniques required decryption of all preceding blocks in the file.

#### Question 15

Not yet graded / 4 pts

What are Symmetric and Asymmetric key algorithms? Briefly explain while highlighting differences between these two categories.

Your Answer:

Symmetric key algorithms use the same key to encrypt and decrypt.

Asymmetric key algorithm generates a key-pair, one for encrypting the other for decrypting.

The main differences are:

- Symmetric key use one key for both encryption and decryption while Asymmetric key algorithm uses two different keys, one for encryption and one for decryption.

Symmetric key algorithms involve the use of same key for both encryption and decryption. One key problem with such algorithms is the sharing of key.

Asymmetric key algorithms involve the use of different keys for encryption and decryption. One good example of such algorithms is public/private key protocol used in RSA.

answered

### Question 16

Not yet graded / 4 pts

Consider a client program that needs to run the following operations on a remote file server:

- List the contents of a directory
- Open a file
- Read a text file
- Display the attributes of a file

For each of the above operations, indicate whether they are more likely to be delay sensitive or bandwidth sensitive. Justify your answer?

Your Answer:

- a. Delay-sensitive; directories are typically of modest size.
- b. Delay-sensitive; the messages exchanged are short.
- c. Bandwidth-sensitive, particularly for large files.
- d. Delay-sensitive; a file's attributes are typically much smaller than the file itself.

answered

### Question 17

Not yet graded / 3 pts

Give an example of application that has stringent requirements on each of the three main characteristics: Bandwidth, Latency, Jitter.

Your Answer:

Bandwidth – HD video  
Latency – Interactive gaming  
Jitter – Real-time video

answered

### Question 18

Not yet graded / 2 pts

Does email application use DNS protocol? If yes, how?

Your Answer:

Yes, Email uses the DNS protocol to translate email server address to IP address.

answered

### Question 19

Not yet graded / 3 pts

What is man-in-the-middle attack problem in authentication?

Your Answer:

In the simple authentication protocol studied in the class where Alice and Bob shares a key based on their randomly selected numbers "x" and "y", an intruder Trudy can intercept the communication in the middle by using a number "z" to control the communication between Alice and Bob. Since Alice and Bob never directly confirm the key with each other, they will not realise the presence of Trudy. This security threat is known as man-in-the-middle problem.

answered

### Question 20

Not yet graded / 2 pts

Given an example of symmetric and asymmetric key generation protocols in network security.

Your Answer:

Symmetric: Counter mode.

Asymmetric: RSA



