

CSC358 Review Notes

Larry Zhang, Winter 2020

Overview

This document provides a list of topics/questions that should be reviewed to prepare for the CSC358 final exam. The important topics that require a deep level of understanding are highlighted by boldface and larger fonts. Examples of possible types of exam questions are also shown wherever appropriate.

Overall, **tutorials** and **assignments** are important and require deep understanding.

For any additional questions about the scope of the topics to be covered, please feel free to ask on the discussion board.

Introduction

What is the network core? What is the network edge?

What is packet switching and circuit switching? How do they compare with each other?

What are the source of delays in packet switching?

Calculation of transmission delay and propagation delay.

What kind of queuing delay is caused under different arrivals rates?

What is throughput How to determine the throughput of a given network?

Possible exam question:

Various delay / throughput related calculations, you will need to perform some simple arithmetic calculations units, e.g., 2Mbps x 40 milliseconds.

What are the layers of the Internet protocol? Why this layered approach?

The Internet is a network of networks? Why does this topology make the Internet scalable?

What is ISP, IXP, CDN, access network and what are their roles in the Internet structure?

Application Layer

The difference between the client-server and peer-to-peer application architectures.

What is a socket? What is the relation between the socket, the IP, the port number and the client / server processes?

What's the difference between the TCP server and the UDP service?

What's HTTP for? How does it work at a high level?

HTTP is stateless. What does it mean?

Persistent HTTP vs non-persistent HTTP.

Possible exam question:

Counting the number of RTTs involved in the typical web page visit.

What does a simple HTTP request / response look like?

What did you have to do to implement a proxy server in A1?

Why do proxy servers / web caches improve the performance of the Internet?

Possible exam question:

Given a network with links of certain bandwidth, calculate the performance gain when using a web cache. Analyze whether or not it makes a difference

What's the purpose of using cookies? How does it work?

What is conditional GET?

How does SMTP work?

What does a typical SMTP request look like? What's the meaning of fields such as HELO, RCPT TO, TO, Data?

How send an email with fake sender / receivers?

Does SMTP using persistent or non-persistent connection?

What's the purpose of DNS?

Why can DNS be scalable?

The hierarchy of the DNS database. Root servers, TLD servers, authoritative servers, local servers.

Iterative query and recursive query.

What is a resource record? What information does it keep? (No need to memorize the detailed format of the message.)

How to use the "dig" tool to make DNS queries?

What is the process of a new startup inserting their record to DNS?

Possible exam question:

Given a scenario where a users requests an URL, calculate the number of DNS queries needed to obtain the result.

What's special about the P2P architecture?

Calculate the file distribution time in client-server and P2P architectures.

What's the basic structure of Bit-Torrent?

What does rarest-first do? Why it is a reasonable rule?

What does tit-for-tat do? Why it is a reasonable rule?

What is the high-level working mechanism of the DASH protocol?

What the difference between "enter deep" and "bring home"?

What happens when a user requests content from Netflix's CDN?

Transport Layer

What is the purpose of multiplexing and demultiplexing?

What's the difference between TCP and UDP demultiplexing?

What's the pros and cons of UDP?

What's the purpose of checksum?

The process of developing the RDT protocols. The assumption made in each step and the solution designed for each problem.

Possible exam question:

Given a specific scenario, design a RDT protocol; or given a RDT protocol, find the flaws in the design, and/or decide how to fix the flaw.

What the advantage of Go-Back-N over Stop-and-Wait?

Possible exam question:

Calculate link utilization of GBN with a certain window size, given packet size and bandwidth; or given the link utilization, calculate the desired window size, packet size, bandwidth, etc.

The detailed working mechanism of GBN, as implemented in A2.

What's the difference between GBN and Selective Repeat?

TCP implementation: what is a segment? What important information is stored in the segment header?

How to determine the sequence number or ACK number of a segment?

How does TCP determine the length of the timeout?

What is exponential weighted moving average? What's purpose of it? How is it calculated?

What RDT protocol does TCP use?

What's the point of "triple duplicate ACKs"?

What's difference between TCP flow control and congestion control?

How does TCP flow control work?

How does TCP establish a new connection? Why three-way handshake?

How does TCP close a connection?

Principle of congestion control

What could cause congestion control in the network?

How does AIMD work in TCP congestion control?

What is slow start? What's the purpose of it?

What's the difference between TCP Reno and Tahoe in terms of window size control?

Network Layer: Data Plane

What is the difference between the Data Plane and the Control Plan?

What is the service model of the Internet?

How is a forwarding table? How does longest-prefix mating work?

What are the differences between input port queueing and output port queueing? What are the circumstances where packets are dropped at the input port and the output port?

What are the different scheduling mechanisms for the buffers? Highly-level idea is enough.

What is an IP address? What is a subset? How does CIDR work?

How does a host get an IP address via DHCP? What are the steps? What is DHCP discover/offer/request/ack? Which one is broadcast and which one is not?

What's the hierarchical structure of IP address?

How does NAT work? What's the purpose of NAT? What does the router need to modify of the requests and responses sent through it?

What're the main differences between IPv6 and IPv4?

How does tunnelling work?

Network Layer: Control Plane

Link state algorithm (Dijkstra) and distance vector (Bellman-Ford) algorithms. How do they work? What's the difference between them? Need to know in great detail.

Know very well what you did in A3.

Understand “good news travels fast” and “bad news travels slowly”.

Possible exam question:

Given a graph, trace the steps of Dijkstra's algorithm or Bellman-ford.

Internet's approach of scalable routing: OSPF + BGP.

What are the roles of intra-AS and inter-AS routing?

What algorithm is used by OSPF?

BGP, iBGP, eBGP. What're their purposes and how do they work?

What is policy-based routing? How does path advertisement work?

How does BGP use AS-PATH and NEXT-HOP?

What is hot potato routing?

Possible exam question:

Given a network topologies with different ASes? Given advertisement policy, determine the available paths; or given the desired paths, design the advertisement policy. For example, the tutorial question on BGP.

What are the things that per-router control cannot do but SDN can do?

Possible exam question:

Given a few example routing outcome, determine which ones require SDN.

Possible exam question:

CRC related calculations. Given D and G, compute R according to CRC. Find D' with the same R, etc.

What is the purpose of ICMP?

How Ping works with ICMP?

How Traceroute work with ICMP?

Link Layer

What is the service provided by the link layer?

What is a frame?

Should link layer provide reliable data transfer?

How does error detection work in general?

How does parity checking work? Both single bit and two dimensional.

How does CRC work?

Why do we need multi-access control protocols? What do we need from a multi-access protocol?

What's channel partitioning? What's its pros and cons?

What's TDMA, FDMA? What's the difference between them.

Random access protocols. Slotted ALOHA, pure ALOHA. The proof for their efficiency.

What's the difference of CSMA from ALOHA?

How does carrier sense work? How do collisions happen?

What's the purpose of collision detection? What does it work?

How does binary backoff work?

Possible exam question:

Proof for the efficiency of slotted ALOHA, pure ALOHA, or variations of them in particular scenarios.

What's the basic idea of "taking turns"? How does polling and token ring work? What are their pros and cons?

What is MAC address? What's its format? How is it different from IP address?

What's the purpose of the ARP protocol? How does it work?

What are the possible physical topologies of Ethernet?

Possible exam question:

Trace the learning process of a switch network, given a sequence of request and replies sent through the network.

Is Ethernet connection-based? Is it reliable? What multi-access control is used by Ethernet?

What's the difference between a hub and a switch?

What's the difference between a switch and a router?

What is in a switch's forwarding table? How does the switch learn it?

What's the purpose of VLAN? How does it work?

Wireless and Mobile

What are the roles of wireless host, base station, and wireless link?

What's the difference between infrastructure mode and ad hoc mode?

What's difference between wireless link and wired link?

What's the structure of a Wi-Fi LAN?

What happens when you associate with an AP?

What MAC protocol is used in Wi-Fi?

How does CSMA/CA work? How do RTS and CTS work?

What's the main difference between 4G and 3G cellular network?

How to communicate with a mobile user? How does indirect routing and direct routing work?

What are the pros and cons between indirect and direct routing?

Why do we have "packet in a packet" in mobile IP?

How does the handoff procedure work?

Possible exam question:

Given a concrete scenario, identify routes based on indirect/direct routing.

Some potential questions that broadly cover all topics.

Possible exam question:

Given some real-life behaviour / intuition, find the closest concept learned in CSC358.

Given the description / clues of the particular concept learned in CSC358, identify the name of the concept. Like Jeopardy!