

## **COMP3721 – Final Exam Review**

### **Data Link Layer:**

- Error Detection and Error Correction,
- Redundancy for Error Control (Dataword, Codeword, number of valid and invalid codewords)
- Block Coding
- Hamming Distance and Error Detection (how many errors can be detected/corrected)
- Linear Block Codes (Parity Check Code)
- Cyclic Codes (CRC) and Syndrome value
- Checksum calculation, One's Complement Arithmetic and Wrapping (Hex)
- FEC
- Framing, Fixed and Variable Size (Byte oriented and Bit oriented approaches – Byte and Bit Stuffing)
- Flow Control, Error Control (Simple and Stop-and-wait Protocols)

### **Random-Access Protocols:**

- Broadcast domain (VLANs to Separate) and Collision Domain
- Random Access Protocols
- Pure Aloha, Slotted Aloha, Vulnerable times, what is G and how do you calculate the Throughputs
- CSMA and its Vulnerable time (based on Propagation time of the Frame)
- Persistent Methods (1/Non/P-persistent methods)
- CSMA/CD and /CA

### **Network Layer:**

- Packet Switch Network (Like Internet), Datagram Networks
- Packetizing
- Routing
- Error Control (Checksum at the header of the datagram, only used for corruption in the header not the whole packet)
- Performance (Total Delay, Propagation, Transmission, Queuing, and Processing Delays)
- Throughput vs. Bandwidth (Throughput is always less than Bandwidth)

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- Throughput vs. Bandwidth (Throughput is always less than Bandwidth)
- IPv4 Addressing (Classful and Classless)
- CIDR (slash) notation, total number of different networks and hosts
- Block Allocation and Subnetting, First Address (Network Address), First host address, Last host address, Broadcast address (Last Address) and subnet design
- Forwarding, Address Aggregation, and Routing Tables
- DHCP and NAT

#### **IPv4:**

- IPv4 Protocol and Datagram Format (Header specifically)
- Checksum calculation, One's Complement Arithmetic and Wrapping (Hex)
- MTU
- Fragmentation (ID, offset, and flag)
- ICMPv4 Protocol (Ping, Traceroute) and types of messages
- IPv6 and transition strategies

#### **Routing and Transport Layer:**

- Unicast Routing
- Network as a Weighted Graph
- Least cost trees, Bellman-Ford, and Distance Vectors (Distance Vector after Initialization, Updating DV using Bellman-Ford)
- Link State (LS, LSP, and LSDB) and finding the shortest path using Dijkstra Algorithm
- Intra-domain Routing Protocols → RIP protocol (Based on DV and number of hops) and OSPF (Based on LS, customizable weight of the links by net admin)
- Transport Layer and its services (Sockets (IP + Port) for process-to-process delivery, Error Control, Flow Control, and Congestion Control

(Using Seq numbers, ACKs, and where/when the error control is applied (corrupted packets, etc.)

- UDP (Connection-less Protocol without any of the features above) and its applications

### **TCP:**

- TCP Buffers
- TCP Numbering system
- TCP Segment Format
- Connection-oriented protocol (Three-way handshake for Establishment and Termination)
- Flow control to prevent overwhelming the receiver (rwnd)
- Error control (ACKs (cumulative), SEQs, Retransmission, and Checksum (on whole segment, not just the header))
- Retransmission types (After Time-out, after Three Dup. ACKs)
- ACK and SEQ number calculation (after packet loss, timeout, etc.)
- Congestion Control to prevent overwhelming the network (cwnd)
- MSS and Congestion control algorithms (Slow Start, Congestion Avoidance)