Exercise 1

I) Route Lookup Operation

A certain router runs the route lookup before classification. If RL operation takes 15 ns, how much time is allowed for classification to reach a throughput of 40 Gbps (average packet size: 100 bytes)? **Show your calculus.**

II) Binary Tries

a. Build a binary trie for the following prefix set. Taking into account that each node in the binary trie requires a memory access, how many memory accesses are needed for a search in the worst case?

Prefix Label	Prefix Value
P1	0*
P2	00001*
P3	001*
P4	1*
P5	1000*
P6	1001*
P7	1010*
P8	1011*
P9	111*

b. For the previous prefixes, build the path-compressed trie. Show the next bit to compare in the matching nodes. In this trie, how many memory accesses are needed for the search of the following 8-bit addresses: 10011000 and 11100011? .

Exercise 2

I) Route lookup operation

How much time is allowed in a given router for route lookup to reach a throughput of 20 Gbps (Data: average packet size: 200 bytes; Router needs 30 ns per packet in other operations) . **Show your computation.**

II) Multibit Trie

Build a multibit trie of fixed stride size for the following prefix set (the prefixes have been expanded to a equivalent set of length 3 and 5). How many memory accesses are needed for the search of the following 8-bit addresses: 10011000 and 11100011?

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Prefix label	Prefix Value	Expanded Prefixes
P1	**0***	**000*; 010*; 011***
P2	**00001***	**00001***
P3	**001***	**001***
P4	**1***	**100*; 101*; 110***
P5	**1000***	**10000*; 10001***
P6	**1001***	**10010*; 10011***
P7	**1010***	**10100*; 10101***
P8	**1011***	**10110*;10111***
P9	**111***	**111***

Exercise 3

The following table represents a forwarding table.

Prefix	Value
P1	10*
P2	01*
P3	110*
P4	0010
P5	0110
P6	0111

a) Build a binary trie for the following prefix set. Show clearly where the prefixes are.

b) Apply the path-compressed trie to Q1 structure (trie PATRICIA). Re-draw the trie showing the required additional information to make searchs (in other words, the number of bits to skip in the nodes where it would be needed)

Exercise 4

The following table represents a forwarding table.

	Prefix/length
P1	0.0.0.0/1
P2	32.0.0.0/3
P3	0.0.0.0/5
P4	8.0.0.0/5
P5	16.0.0.0/5
P6	24.0.0.0/5
P7	64.0.0.0/2
P8	128.0.0.0/2
P9	192.0.0.0/3
P10	224.0.0.0/3

a) Build a binary trie for the prefix set in the table. How many memory access are required in the worst case? Note: Assume the root node does not imply a memory access.

b) Apply the path-compressed trie). Re-draw the trie showing the required additional information to make searchs (in other words, b = bit to look at; c= bit string to be compared with in case it is required)

c) Build the multibit trie using a fixed stride size equal to 2.

Exercise 5

The following table represents a forwarding table.

	Prefijo/longitud
P0	0.0.0.0/0
P1	116.0.0.0/6
P2	120.0.0.0/6
P3	124.0.0.0/6
P4	224.0.0.0/4
P5	224.0.0.0/6
P6	236.0.0.0/6
P7	252.0.0.0/6

a) Build a binary trie for the prefix set in the table. How many memory access are required in the worst case? Note: Assume the root node does not imply a memory access.

b) Apply the path-compressed trie). Re-draw the trie showing the required additional information to make searchs (in other words, b = bit to look at; c= bit string to be compared with in case it is required)

c) Build the multibit trie using a fixed stride size equal to 3.