

# Midterm: NET2000 – Intermediate Networking

Fall 2022

Time: **100** minutes; Test scored out of: **70** Total Marks available: **77**  
(Allocation of marks is shown beside each question)

## **INSTRUCTIONS:**

1. **BEFORE** answering any questions, please check that your copy of the test has all pages (as indicated in the footer at the bottom of each page).  
Please **read all questions** carefully, then answer question 0 first!
2. This is a **closed book** test. No textbooks, notes, electronic devices, or any other aids are permitted.
3. For all multiple choice questions:
  - questions are worth 1 mark unless otherwise noted;
  - choose the best answer unless the question indicates otherwise;
  - a **penalty of –5 marks** will apply if you don't bubble your student ID or test version!
4. All references to the textbook relate to the book with ISBN-13: 978-0-13-663432-4
5. If you are uncertain what a question is asking, make reasonable assumptions, write those assumptions down on this test paper, and continue answering the question.

0. What is your:

NAME?      Answers \_\_\_\_\_

## **VERSION B**

- A. [2 marks] Demonstrate your understanding of how OSPFv3 communicates with neighbours by **clearly** explaining why a router running OSPFv3 can **never** interoperate with OSPFv2.

OSPFv2 only uses IPv4 addresses to communicate with neighbors; it is not capable of using IPv6 packets so can't reach IPv6-speaking neighbours..

OSPFv3 only uses link-local IPv6 addresses to communicate with neighbors; it **never** uses IPv4 packets so can never reach IPv4-speaking neighbours (e.g. OSPFv2)

This is true *even though it is possible to configure OSPFv3 for IPv4* AF (Addr. Families)

OSPFv3 can share LSAs about IPv4 subnets, but only speak/share this via IPv6.

Ref: Wk07-OSPFv3 slide 20

- B. [3 marks] Correctly name and **clearly** identify the seven (7) operational states in the OSPF peering process. For each one, give a one-line description of what's happening. [Ref: Wk3] [1 mark] Be sure to indicate the states where *Neighbour*, and *Adjacency* occur.

Down: OSPF isn't configured or is shut down; no Hello's sent or received (yet)

Init: Sending Hello's to reserved multicast address for OSPF; no neighbours known (yet)

Two-way: Received Hello(s) with my Router ID; **Neighbour**; elect DR/BDR on bcast link

Exstart: Determine which router is Leader, Follower; the leader determines Sequence #

Exchange: exchange DataBase **Description** (DBD) packets

Loading: having DBD, send requests (LSR) to neighbour; get back updates (LSU); LSAck

Full: meaning fully **Adjacent**; routers are fully synchronized; SPF runs to determine routes

DR/BDR election has *nothing* to do with leader/follower decision for Exstart!

Leader/follower *always* needed for Exstart, regardless of link type (multi-access vs p-to-p)

- C. [2 marks] For a *collapsed-core* network design, **clearly** explain: [Ref: Ch 11.1]  
A. the total number of layers and which layers have been "collapsed together"; and  
B. an example where collapsed-core is more suitable than a three tier design.

A. 2 layers: core + distribution as one layer, access layer as the other layer

B. Smaller enterprise networks which have fewer users and smaller connectivity needs

- D. [3 marks] In this course we examined five (5) different methods which contribute to network scalability. Identify and **clearly** describe at least 3 of those methods. [Ref: Ch 11.2]

Please see slides 16-21 in Wk02-HierarchicalNetworks for full details:

Plan for Redundancy: multiple links, switches, routers, routes

Reduce failure domain size: smaller subnets, fewer subnets per router, #routers per area

Increase bandwidth: higher speed links (or extra links); Link aggregation (Etherchannel)

Expand the access layer: often by using wireless; extra switches possibly with more ports

Tune routing protocols

- E. [1 mark] \*What is the most compact notation for the IPv6 address [Ref: Wk02-IPv6]  
B514:82C3:0000:0000:0029:EC7A:0000:EC72?

B514:82C3::29:EC7A:0:EC72

- F. [1 mark] \*Write the command to configure an IPv6 default static route, given that the neighbour router has an interface address of 2001:BEEF:CAKE::1/64. [Ref: Wk02, Lab 3]

```
ipv6 route ::/0 2001:BEEF:CAKE::1
```

Note for 2022: "K" isn't a valid hexadecimal digit so technically the address is invalid

- G. [1 mark; Bonus] What is the ISBN of the required textbook for this course?

Please read the instructions! The book is ISBN-13: 978-0-13-663432-4

- H. [3 marks] Name and **clearly** describe the three data structures used by OSPF. [Ref: Wk03]

Need clear, correct, accurate descriptions for the three!

Adjacency DB / Neighbour table

Link State DB / Topology table

Forwarding DB / Routing table

See slide 7 of Wk03-OSPFv2Basics for full details

- I. [1 mark] Given the IP and Mask 148.26.153.70/23 determine the subnet address. Give your answer in CIDR notation. [Ref: Lab 1 - subnetting]

148.26.152.0/23

- J. [1 mark] Given the Network ID 23.144.221.0/27, determine the smallest subnet possible that provides 8 usable hosts per subnet. Give the subnet address in CIDR notation. [Lab 1]

23.144.221.0/28

- K. [1 mark] From the network 219.205.119.108/25, subnet to provide at least 12 subnets while maximizing the number of hosts per subnet. Give the new mask in CIDR notation, and the number of usable hosts per subnet. [Ref: Lab 1 - subnetting]

/29 with 6 hosts per subnet

- L. [1 mark] For a converged network (as defined in ENSA Ch 11), **clearly** identify the three types of traffic in the network? [Ref: Ch 11; Quiz 1]

Voice, video, data



Q. [1 mark] (Cisco IOS) What statement controls whether a router generates RA messages for IPv6 hosts? Type the CLI configuration line. [Ref: Lab 3 Task 5]

ipv6 unicast-routing

R. [2 marks] Clearly identify the precedence (or process) that Cisco IOS uses to choose the router ID for OSPF. [Ref: Wk03 OSPF config - slide 9]

1. Router ID explicitly configured (within the OSPF process);
  2. Highest IP address on a virtual interface (i.e. loopback) that is UP
  3. Highest IP address on a physical interface that is UP
- Otherwise, there's no router ID and the OSPF process can not be started.

S. [3 marks] **Clearly** identify each of the layers in three tier hierarchical network design model. For each layer, provide a short but **clear** description of its purpose and role. [Ref: Ch 11.1] [You may find it helpful to draw a diagram that you can reference in your description(s).]

Core: Backbone; provides connections between distribution layers for large environments  
this layer does routing (and not L2 switching)

Distribution: **aggregation** point for access layer; a boundary for **services and control**  
this layer is typically the boundary between the switched L2 and routed L3 layers

Access: Gives endpoints and **users** direct access to the network via wired or wireless connections

T. [1 mark] **Clearly** explain the purpose of *passive* interfaces in OSPF. [Wk03 config, slide 20] (It may be easiest to state what passive interfaces do and don't do.)

What they do: OSPF includes the subnet associated with the interface in the LSAs  
i.e. shares information of the subnet to neighbours, just like other interfaces

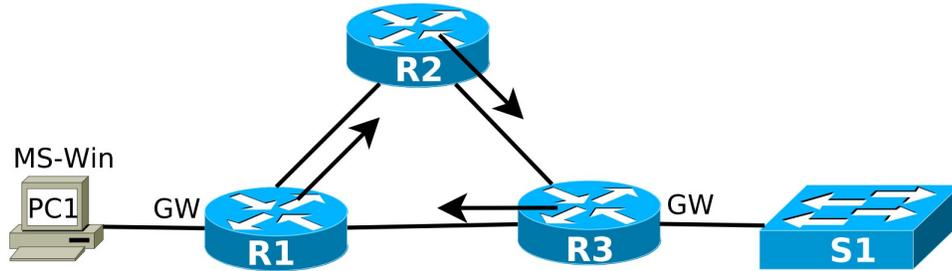
What they don't do: no Hello or other OSPF messages are sent out those interfaces  
i.e. other devices on that same segment are not spammed with OSPF msgs

U. [2 marks + 1 Bonus] **Clearly** explain when the Routing Table Manager (RTM) process uses *preference*, and when it uses the *metric* for deciding whether to install a candidate route in the main routing table. HOW does it use each one? For an extra mark: **clearly** explain the situation when it doesn't need to check either one. [Ref: Wk07Day1]

Exact same route from exact same protocol: check the **metric**; keep/install winning route  
Exact same route, different protocols: check the **preference**; keep/install winning route

Neither the preference nor metric are checked for the purpose of **forwarding a packet!**  
Also accepted: either is checked if this is brand-new route (or mask), not already in the RT

- V. [2 marks; 1 per row] Examine the topology diagram carefully, then fill out the chart below with the TTL values for each ping combination. All routing is static and arrows indicate the egress interface of the static default route for each router. [Ref: Labs 2, 6]



Ping Src/Dest	To PC1	To R1	To R2	To R3	To S1
From PC1	128	255	253	254	253
From S1	125	253	254	255	255

- W. [2 marks] You've undoubtedly studied very hard for this midterm. There's surely a question you were expecting/hoping would be on the test but isn't. Now's your chance:
- **Clearly** state your question (must NOT be a duplicate of any existing question)
  - **Clearly** state the correct answer.
- Make sure your question is worth 2 marks: the answer must have at least two distinct parts!

Because the student chooses their own question, the answer **MUST** really be completely correct. No vague, unclear explanations are acceptable.

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### Extra Work