

Professional Certificate of Competency in Advanced TCP/IP-Based Industrial Networking

(CAV)

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| **Student full name:** |  | | | |
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|  | | | | |
| Marks (%) | |  | Satisfactory / Not Satisfactory | |
| Assessor: | |  | Date: |  |
| Overall feedback: | |  | | |

**Assessment Instructions:**

1. You must answer ALL questions.
2. Please ensure you complete your answers in a blue font (not red or black).
3. The best marks can be earned by giving concise, brief answers that address the questions.
4. You must reference all content used from other sources including course materials, slides, diagrams, etc. Do not directly copy and paste from course materials or any other resources.   
   Refer to the referencing section of the [EIT eLibrary](https://moodle.eit.edu.au/course/view.php?id=1054) on Moodle for referencing guides.
5. Use this document for completing your answers by typing the answers after each question without deleting the question. Make sure that you preserve the original question number format.
6. Do not add extra pictures, etc. as annexures; instead, paste them directly into this answer sheet. Hand-drawn sketches can be inserted after scanning but please ensure that the file size does not become big (more than 10 MB). You must refer to all diagrams and pictures, etc. that you have drawn or pasted in.
7. When saving your document (must be Word format), ensure you include your name in the title: COURSECODE\_MODULE#\_ASSESSMENTTYPE\_VERSION#\_YOURNAME

**E.g. CAV\_M7-12\_Assessment1\_v3\_JohnSmith**

1. Please ensure you complete the Student Declaration on the front page to verify your assessment submission as your own material.

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| **Modules:** | **Modules 1 to 6** |
| **Assessment:** | **Assessment 1** |
| **Version:** | **3** |
| **Total marks:** | **160** |

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| --- | --- | --- | --- | --- | --- |
| **PART 1: WRITTEN COMPONENT (120 marks)** | | | | | |
| **Q1** | Describe the size and purpose of the following fields in the Ethernet V2 frame:   1. Preamble 2. Destination Address 3. Type 4. FCS | | | **(4 marks)** | |
| **A1** | Student answer | | | | |
| **F1** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q2** | What is a ‘MAC address’? | **(2 marks)** | | | |
| **A2** | Student answer | | | | |
| **F2** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q3** | Give four differences between Blue Book (V2) and IEEE 802.3 frames. | | | | **(4 marks)** |
| **A3** | Student answer | | | | |
| **F3** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q4** | Describe the following three variants of the IEEE 802.3 standard:   1. IEEE 802i 2. IEEE 802u 3. IEEE 802ab | | **(3 marks)** | | |
| **A4** | Student answer | | | | |
| **F4** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q5** | List the media used by the following standards:   1. 1000BaseSX 2. 1000BaseLX 3. 1000BaseT | | | | **(3 marks)** |
| **A5** | Student answer | | | | |
| **F5** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q6** | Discuss two alternative connectors used with Industrial Ethernet. | | | | **(4 marks)** |
| **A6** | Student answer | | | | |
| **F6** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q7** | Briefly discuss the following protection components used with Intrinsically Safe Ethernet:   1. isolators 2. cables 3. glands 4. connectors | | | | **(4 marks)** |
| **A7** | Student answer | | | | |
| **F7** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q8** | 1. Name any four devices that use PoE. 2. What amount of power is available in the IEEE 802.3af and IEEE 802.11at specifications respectively? | | **(6 marks)** | | |
| **A8** | Student answer | | | | |
| **F8** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q9** | Write short notes on the following:   1. PPP 2. SLIP 3. PPPoE | | | | **(6 marks)** |
| **A9** | Student answer | | | | |
| **F9** | Assessor feedback: | | | **(marks awarded)** | |
|  | | | | | |
| **Q10** | Discuss the IPv4 header structure and its various fields in detail. | | | | **(6 marks)** |
| **A10** | Student answer | | | | |
| **F10** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q11** | 1. Draw a neat sketch of the formal classful IP address structure. (Do not copy from a textbook)   Run the ipconfig /all command in your command box (Windows) or similar on your machine.   1. What is your device’s current IP address? 2. From what data can you determine the Network ID? 3. Identify the HostID and NetID for your IP address. | | | | **(5 marks)** |
| **A11** | Student answer | | | | |
| **F11** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q12** | List the default subnet masks for the various classes of IP addresses, using the prefix notation. | | | | **(2 marks)** |
| **A12** | Student answer | | | | |
| **F12** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q13** | List the IP ranges of private networks. | | | | **(2 marks)** |
| **A13** | Student answer | | | | |
| **F13** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q14** | Execute the following commands in the command prompt and snag your outputs.   1. Run getmac and identify your MAC address currently in use. 2. Run arp –a and show the content of your address cache. 3. Run ping and show the responses. | | | | **(3 marks)** |
| **A14** | Student answer | | | | |
| **F14** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q15** | Draw an illustration of the various fields in an IPv6 header. (Do not copy / paste from a textbook) | **(3 marks)** | | | |
| **A15** | Student answer | | | | |
| **F15** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q16** | Compare the IPv6 multicast, unicast and anycast mechanisms. | | **(2 marks)** | | |
| **A16** | Student answer | | | | |
| **F16** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q17** | Give examples of IPv4 and IPv6 link-local addresses, and name a specific scenario where they would be used. | | **(2 marks)** | | |
| **A17** | Student answer | | | | |
| **F17** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q18** | 1. Draw a neat sketch showing an ICMPv6 frame. 2. What is the Type number for an Echo Request message? | | | | **(2 marks)** |
| **A18** | Student answer | | | | |
| **F18** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q19** | What is the fundamental difference between TCP and UDP? | | **(1 marks)** | | |
| **A19** | Student answer | | | | |
| **F19** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q20** | After establishing a connection with a server, a TCP client sends 100 bytes of data with a sequence number of 11301.  Assuming that the message is received successfully, what acknowledgement number could the server return? | | **(3 marks)** | | |
| **A20** | Student answer | | | | |
| **F20** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q21** | What is the difference between well-known, registered, and ephemeral ports, and which numbers are reserved for each category? | | | | **(2 marks)** |
| **A21** | Student answer | | | | |
| **F21** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q22** | 1. Name four functions of TCP. 2. Explain the use of the following flags in the TCP header:    1. SYN    2. ACK    3. FIN    4. RST | | | | **(4 marks)** |
| **A22** | Student answer | | | | |
| **F22** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q23** | 1. List three applications of UDP. 2. Under which conditions will the value contained in the ‘Message Length’ field in the UDP header be equal to 8? | | | | **(4 marks)** |
| **A23** | Student answer | | | | |
| **F23** | Assessor feedback: | | | **(marks awarded)** | |
|  | | | | | |
| **Q24** | 1. List two functions of HTTP. 2. Which two ports are used by FTP (and for what purposes)? 3. What is the purpose of DNS? 4. How does DynDNS differ from DNS? 5. What are the key components of SNMP? | | **(5 marks)** | | |
| **A24** | Student answer | | | | |
| **F24** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q25** | Explain in your own words, the purpose of each of the following:  *(Please do not copy/paste. One sentence each will do)*   1. BootP 2. DHCP | | | | **(2 marks)** |
| **A25** | Student answer | | | | |
| **F25** | Assessor feedback: | | | **(marks awarded)** | |
|  | | | | | |
| **Q26** | What is APIPA and when is it used? | | **(2 marks)** | | |
| **A26** | Student answer | | | | |
| **F26** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q27** | Describe the basic operation (and difference between) L2 and L3 Ethernet switches. | | **(2 marks)** | | |
| **A27** | Student answer | | | | |
| **F27** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q28** | What is the basic difference between Ethernet hubs and switches? | | | | **(2 marks)** |
| **A28** | Student answer | | | | |
| **F28** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q29** | What is the difference between Ethernet bridges and switches? | | | | **(1 marks)** |
| **A29** | Student answer | | | | |
| **F29** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q30** | What is the basic difference between L3 Ethernet switches and routers? | | | | **(1 marks)** |
| **A30** | Student answer | | | | |
| **F30** | Assessor feedback: | | | **(marks awarded)** | |
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| **Q31** | A client with MAC address ‘a’ and IP address 10.0.0.1/8 sends a packet to its Default Gateway with MAC address ‘b’ and IP address 10.0.0.100/10. The router then uses its other port with MAC address ‘c’ and IP address 202.168.0.100/24 to forward the packet to the server with MAC address ‘d’ and IP address 202.168.0.1/24.  List the source/destination MAC addresses as well as source/destination IP addresses for a packet captured on the link between the client and the router. | | **(4 marks)** | | |
| **A31** | Student answer | | | | |
| **F31** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q32** | Describe, briefly, the essence of each of the STP variants. Please use your own words, and do not copy and paste. Additional browsing / on-line research is suggested. | | | | **(3 marks)** |
| **A32** | Student answer | | | | |
| **F32** | Assessor feedback: | | | **(marks awarded)** | |
|  | | | | | |
| **Q33** | Draw and explain the various fields of an IEEE 802.3p/Q Ethernet frame. | | **(4 marks)** | | |
| **A33** | Student answer | | | | |
| **F33** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q34** | List the 5 elements of QoS. | | **(5 marks)** | | |
| **A34** | Student answer | | | | |
| **F34** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q35** | Explain the basic operation of an HSR network as per IEC 62439-3. | | | | **(2 marks)** |
| **A35** | Student answer | | | | |
| **F35** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q36** | What do you understand by the term PRP? | | | | **(2 marks)** |
| **A36** | Student answer | | | | |
| **F36** | Assessor feedback: | | | **(marks awarded)** | |
|  |  | | | | |
| **Q37** | Describe, in your own words, the basic operation of IEEE802.1X. | | | | **(4 marks)** |
| **A37** | Student answer | | | | |
| **F37** | Assessor feedback: | | | **(marks awarded)** | |
|  | | | | | |
| **Q38** | Explain, briefly, in your own words, the concept (and implementation) of Link Aggregation as per IEEE802.3ad. You may have to do some additional online research here. | | **(4 marks)** | | |
| **A38** | Student answer | | | | |
| **F38** | Assessor feedback: | | | **(marks awarded)** | |

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| **PART 2: PRACTICAL COMPONENT (40 marks)**  The exercise, software and other documentation referred to has been uploaded to Moodle. Also see instructions for accessing the Remote Lab facility. Please contact your instructor if you experience any difficulties.  If you are new to this, see the additional notes. You need to be able to ‘ping’ another device. This can be another computer on your home network, even your broadband router. Alternatively, you can ping a site on the Internet. You may have problems if using a 3G/4G connection, please contact your lecturer.  If you don’t have Wireshark yet, just download the latest version from the Internet [here](http://www.wireshark.org/download.html) and install. Make sure that you install ‘winpcap’ as well, when prompted.  In order to snag your results (as jpg files), there are many screen capture programs on the Internet. There are good free ones such as ‘Screenhunter’ or Jing. When you install free software, always choose the ‘advanced’ option and uncheck all boxes that wat you to install toolbars etc. Snagit by Techsmith is excellent but will cost you some money and you probably do not need the editing function anyway.  The easiest way to use the snag program is to set it up to save the captured image on the clipboard, and then insert the image into your document with Cntl-C, Cntl-V.  When requested to capture a header, capture only that (i.e. set up your screen capture software to capture a ‘region’. Please do not capture the entire screen as it is difficult to read.  If you want to change your IP address, but are not sure how to do it, just Google how to set your ip address as well as your Operating System and version thereof.  There are many videos for Wireshark on the Internet, especially on Wireshark University. | | | | |
| **Q39** | **Network Layer Protocols: IPv4**  Run arp –a from the Command Prompt in order to view the contents of the ARP cache. The details pertaining to your ADSL router will already be there.  If you are using another computer for a target device and it does not appear in the cache yet; just ping it and the details (IP/MAC addresses) will appear.  Snag the ARP Cache. | | | **(3 marks)** |
| **A39** | Student answer | | | |
| **F39** | Assessor feedback: | | **(marks awarded)** | |
|  | | | | |
| **Q40** | **Network Layer Protocols: IPv4**  There are two ways of doing the following exercise.   1. If you are using another computer, you have to make sure its details have been removed from the ARP cache. You can wait a while for this to happen (3-20 minutes depending on your Operating System), or you can remove it with the arp command and using the ‘-d’ switch. To check all the possibilities (‘switches’) type arp /? You can then start Wireshark, ping the other machine, and Wireshark will capture the ARP messages. 2. If you are using the ADSL router for this exercise, be aware that the system will restore its entry in the ARP cache as fast as you delete it. However, this is still done by means of ARP messages; the only *caveat* is that you need to have Wireshark running before you delete the ADSL router entry in the cache     After invoking the ARP messages, look at the top part of the Wireshark display. There will be two ARP messages; an ARP Request emanating from your PC, and an ARP Response. Now look at the middle part of the screen and expand the ARP headers in turn (double-click or click on the [+]). Notice that in the first one (broadcast to ff:ff:ff:ff:ff:ff) the one MAC address is missing. This is what your PC is looking for. In the second ARP message this info is supplied (although source and destination have been transposed).   1. Snag the ARP *Response* packet (the second packet in the pair of ARP messages, (NOT the ARP Request). (2 marks) 2. What is the MAC address of the second device? (1 mark)   Now go back to the top of the screen: select one of the ICMP *Echo* *Response (*a.k.a. *Echo Reply)* Messages. This is an incoming response to your ‘ping’. Note the three headers: the Ethernet header, the IP header, and the ICMP header. Go to the middle section of the screen, expand all the headers, and confirm the MAC addresses and IP addresses involved here.  *Always ignore the first line on the centre section of Wireshark, as this relates to OSI layer 1 and only gives statistics for the raw data.*   1. What is the ICMP type (the first field in the ICMP header)? Give both the number and its meaning. (1 mark) 2. What is the data content of ping message carried (i.e. the stuff following the ICMP header? Give the answer in ASCII. See the right-hand side of the bottom section of the Wireshark display. Hex is on the left; ASCII on the right. (2 marks) 3. Snag the expanded IP header only and paste it below. (2 marks) 4. Snag the expanded ICMP header only and paste it below. (2 marks) | **(10 marks)** | | |
| **A40** | Student answer | | | |
| **F40** | Assessor feedback: | | **(marks awarded)** | |
|  |  | | | |
| **Q41** | **Network Layer Protocols: IPv6**  Work through Exercise 15(b) (IPv6 supplement) and answer the following questions.   1. Snag your *ipconfig /all* result and paste it in here. (2 marks) 2. What is the IPv6 address of the network interface (e.g. Ethernet) you are currently using? (2 marks)   Generate IPv6 packets with Ostinato as per Exercise 15(b).   1. Capture any IPv6 frame, snag the header, and paste it in here. (2 marks) 2. For the header above, supply the following details: (4 marks) 3. Version 4. Traffic class 5. Flow label 6. Payload length 7. Next header 8. Hop limit 9. Source IP address 10. Destination IP address | **(10 marks)** | | |
| **A41** | Student answer | | | |
| **F41** | Assessor feedback: | | **(marks awarded)** | |
|  |  | | | |
| **Q42** | **Host-to-Host and Application Layer Protocols**  Work through Exercise 16 (TCP/IP) and do the following (no need to snag any screens other than the two mentioned below:   1. Snag the triple handshake and paste it in below (2 marks) 2. Snag an HTTP header and paste it in below (2 marks) 3. Work through exercise 16(b) (UDP) 4. Snag a UDP header, and paste it here: (2 marks) | | | **(6 marks)** |
| **A42** | Student answer | | | |
| **F42** | Assessor feedback: | | **(marks awarded)** | |
|  |  | | | |
| **Q43** | **Switching**  Work through Exercise 38 (Managed Switch) and paste your results here. SS1 refers to Screenshot 1 etc. There is no need to do the SNMP section at the end of Exercise 38.  Paste SS1, SS2, SS3, SS4, SS5 below.    The exercises are sometimes moved between labs, so the lab number in the instructions may not be correct. Just do a search on Electromeet. | | | **(5 marks)** |
| **A43** | Student answer | | | |
| **F43** | Assessor feedback: | | **(marks awarded)** | |
|  |  | | | |
| **Q44** | **Advanced Switching**  You are designing an Industrial network with three switches and, because of the need for a high degree of availability, you need to build in redundancy via a ring. In this regard your switches MUST conform to IEC 63439-3.  The switches are approximately 500m apart, and each switch has a maximum of 4 devices attached to it.  Identify the specific switch you would use (find one on the Internet).  Please copy and paste the URL so the assessor can check the switch specifications. You may also paste a screenshot of the switch.  Explain how you would interconnect the switches (including which ports you would use).  Note that conformance to HSR (IEC 62439-3) will be clearly shown on the switch’s data sheet. If it does not say HSR then the switch does not support it. | | | **(6 marks)** |
| **A44** | Student answer | | | |
| **F44** | Assessor feedback: | | **(marks awarded)** | |

**END OF ASSESSMENT**