[CRT10]

UNIVERSITY OF BOLTON

CREATIVE TECHNOLOGIES

COMPUTER NETWORKS AND SECURITY

SEMESTER TWO EXAMINATIONS 2018/2019

WIRELESS AND MOBILE NETWORKS

MODULE NO: SEC5004

Date: Monday 20th May 2019 **Time: 10:00 – 12:00**

INSTRUCTIONS TO CANDIDATES:

There are FOUR questions on this paper.

Answer QUESTION 1 and any TWO other questions.

Question 1 carries 50 marks.

Questions 2, 3 and 4 each carry 25 marks.

Marks for parts of questions are shown in brackets.

Silent electronic calculators may be used provided that data and programme storage memory is cleared prior to the examination

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Question 1 – <u>COMPULSORY</u>

1. Refer to the Abbelaird Ventures supporting material at the back of the exam paper for all parts of this question.

   a) During your visit to Abbelaird Ventures you find a wireless access point (ESSID: Belkin_f5d; BSSID: 00:11:50:8E:1F:9A) hidden behind a cupboard in the staff lounge. One of the staff tells you that they brought an old access point in from home so that they could use their personal tablet in the staff lounge. What kind of security threat is this, what are the risks involved and how could the need for this access point be removed?

   (10 marks)

   b) Some recent trainees claim that their social media credentials and bank details were stolen while they were on a training course at Abbelaird Ventures. The affected trainees were all taught in Training Room C and used the av_guest WLAN. You suspect that they were the victims of an Evil Twin attack. Use the supporting material to prove your suspicion, provide the Managing Director with an overview of how an Evil Twin attack works and suggest how the risk might be reduced.

   (16 marks)

   c) Some of the wireless VoIP phones lose wireless connectivity when training staff move between certain rooms. The problem only happens in certain rooms and the VoIP phone from Training Room B is not affected. The same thing happened when some laptops from Training Room A were used in Training Room C for a large class. Use the site survey data to explain why this is happening and how the situation can be resolved.

   (12 marks)

   d) Users are complaining of poor wireless performance and you suspect that channel selection could be one issue. Use the supporting data to explain why this is the case and suggest how and why the situation might be improved using either the existing access points or new equipment.

   (12 marks)

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Answer <u>ANY TWO</u> of the following three questions

2. a) A power meter at the output of a wireless amplifier reads 39 dBm. Calculate the output power in watts. Explain what is meant by "half power points" and what the value is in this example. **(6 marks)**

   b) An antenna has a gain of 16 dBi, an access point has an output power of 35 dBm and the cable connecting them has a loss of 4 dB. Calculate the EIRP in watts emitted from the antenna. **(6 marks)**

   c) Explain the fundamental relationship between frequency and wavelength and therefore calculate the wavelength of a 22 GHz signal. **(3 Marks)**

   d) Discuss the mechanism that enables hidden nodes in a WLAN network to communicate effectively. **(10 marks)**

3. a) Discuss the concept of the "Internet of Things" and discuss the security and privacy challenges it presents. **(15 marks)**

   b) Explain the operation of an access point in root mode, bridge mode and repeater mode. **(10 Marks)**

4. a) Explain what is meant by reflection in the context of radio waves and describe how this affects radio coverage. **(5 marks)**

   b) Explain how MAC address filtering works and explain why this should not be relied upon to secure a WLAN. **(8 marks)**

   c) Discuss in detail the operation of 16 QAM digital modulation. **(12 marks)**

END OF QUESTIONS

Supporting information for question 1 over the page….

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Supporting Information for Question 1

Abbelaird Ventures (AV) provides technical training. The company occupies half of the shared building shown in Figure 1. Other businesses use the rest of the building as also shown in Figure 1.

AV began with one training room (Training Room A) and an admin office. The company recently expanded and now has two more training rooms (Training Room B and Training Room C) and a staff lounge.

AV's Managing Director found some spare wireless access points in a cupboard and installed these in Training Room B and Training Room C. Table 1 shows the locations of known access points installed by the company along with selected configuration details.

ESSID	BSSID	Channel	802.11	Encryption	WPS?	Location
av_staff	3F:22:8D:90:AE:54	1	b,g	WPA2-AES	Yes	Admin office
av_staff	3F:22:8D:90:43:29	1	b,g	WPA2-AES	Yes	Training Room A
av_train_a	27:55:0F:47:CB:82	1	b,g	WEP	No	Training Room A
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Training Room B
av_train_c	27:55:0F:47:35:92	11	b,g	WEP	No	Training Room C
av_guest	27:55:0F:47:99:D4	1	b,g	None	No	Training Room A
av_guest	27:55:0F:47:29:F1	1	b,g	None	No	Admin Office

Table 1: Abbelaird Ventures access point locations.

The av_staff WLAN is for company devices such as admin laptops and mobile phones.

The av_train_a, av_train_b and av_train_c WLANs are for training laptops and the wireless VoIP phone used each training rooms.

The av_guest WLAN is for visitors, trainees and staff bring your own device (BYOD) use. This WLAN is on a separate VLAN to the other WLANs.

AV has employed you to solve a number of wireless LAN issues. Table 2, Table 3, Table 4, Table 5 and Table 6 show your latest wireless site survey results.

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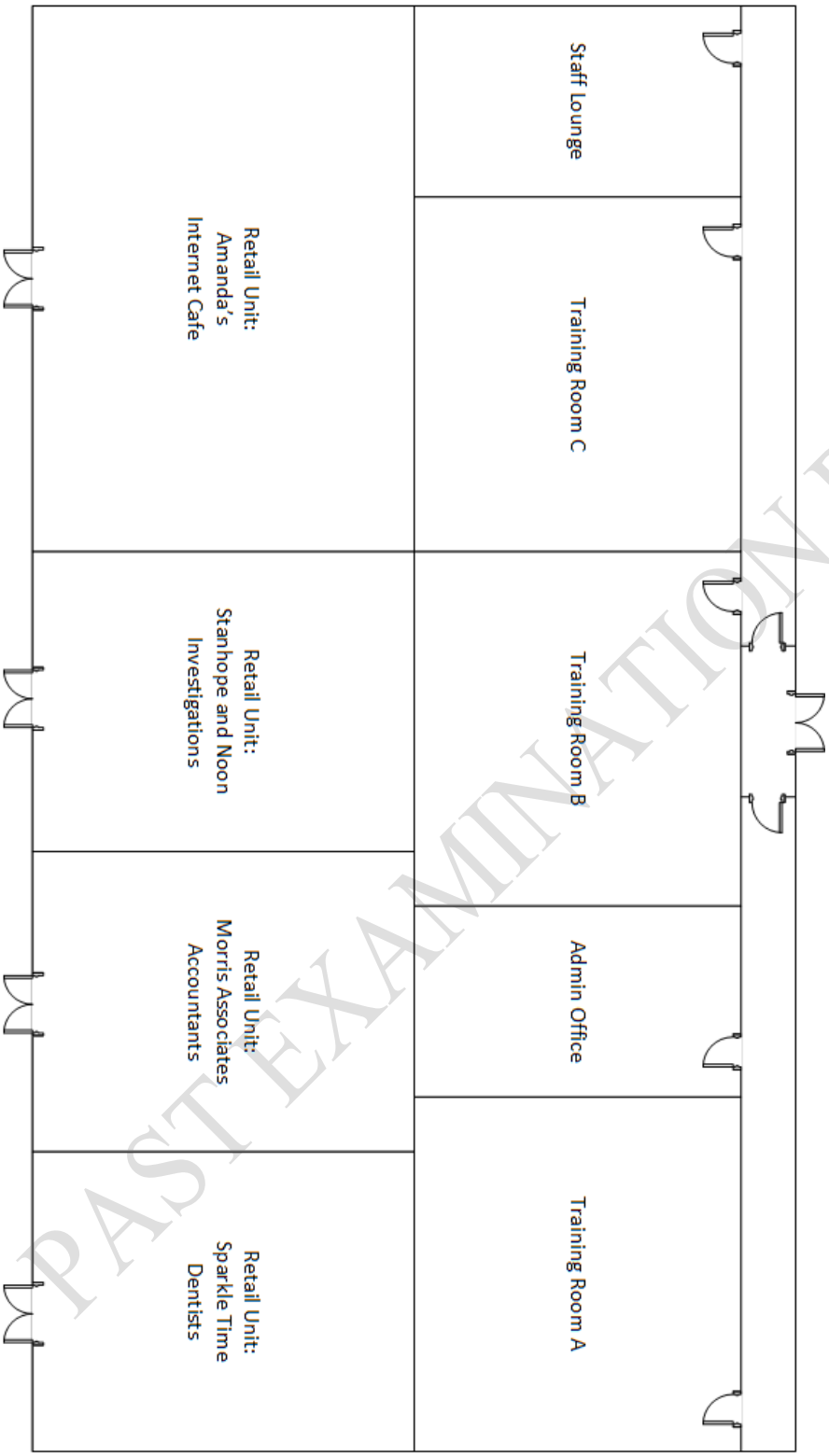

Figure 1: Floor Plan

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ESSID	BSSID	Channel	802.11	Encryption	WPS?	Signal Strength
av_staff	3F:22:8D:90:AE:54	1	b,g	WPA2-AES	Yes	Excellent
av_guest	27:55:0F:47:99:D4	1	b,g	None	No	Excellent
av_staff	3F:22:8D:90:43:29	1	b,g	WPA2-AES	Yes	Good
av_train_a	27:55:0F:47:CB:82	1	b,g	WEP	No	Good
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Good
av_guest	27:55:0F:47:29:F1	1	b,g	None	No	Good
sparkletime	81:44:91:BF:92:32	1	b,g	WPA2-AES	Yes	Good
plusnet8732	41:87:36:92:E3:F0	6	b,g	WPA2-TKIP	Yes	Good
sky82939	71:22:94:DA:3C:93	1	b,g	WPA2-AES	Yes	Good
av_train_c	27:55:0F:47:35:92	11	b,g	WEP	No	Poor
netcafe	53:72:03:CC:5B:8E	6	b,g	WPA2-ENT	No	Poor
sky82939	71:22:94:DA:3C:94	122	a,n,ac	WPA2-AES	Yes	Poor

Table 2: Admin Office site survey results.

ESSID	BSSID	Channel	802.11	Encryption	WPS?	Signal Strength
Belkin_f5d	00:11:50:8E:1F:9A	1	b	None	No	Excellent
av_guest	12:34:56:78:90:AB	1	b,g	None	No	Good
av_train_c	27:55:0F:47:35:92	11	b,g	WEP	No	Good
netcafe	53:72:03:CC:5B:8E	6	b,g	WPA2-ENT	No	Good
netcafe	53:72:03:CC:29:65	11	b,g	WPA2-ENT	No	Good
netcafe	53:72:03:CC:29:66	46	a,n,ac	WPA2-ENT	No	Good
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Poor
netcafe	53:72:03:CC:5B:8F	38	a,n,ac	WPA2-ENT	No	Poor
sky82939	71:22:94:DA:3C:93	1	b,g	WPA2-AES	Yes	Poor

Table 3: Staff Lounge site survey results.

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ESSID	BSSID	Channel	802.11	Encryption	WPS?	Signal Strength
av_staff	3F:22:8D:90:43:29	1	b,g	WPA2-AES	Yes	Excellent
av_train_a	27:55:0F:47:CB:82	1	b,g	WEP	No	Excellent
av_guest	27:55:0F:47:99:D4	1	b,g	None	No	Excellent
av_staff	3F:22:8D:90:AE:54	1	b,g	WPA2-AES	Yes	Good
av_guest	27:55:0F:47:29:F1	1	b,g	None	No	Good
sparkletime	81:44:91:BF:92:32	1	b,g	WPA2-AES	Yes	Good
plusnet8732	41:87:36:92:E3:F0	6	b,g	WPA2-TKIP	Yes	Good
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Poor
sky82939	71:22:94:DA:3C:93	1	b,g	WPA2-AES	Yes	Poor

Table 4: Training Room A site survey results.

ESSID	BSSID	Channel	802.11	Encryption	WPS?	Signal Strength
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Excellent
av_staff	3F:22:8D:90:AE:54	1	b,g	WPA2-AES	Yes	Good
av_train_c	27:55:0F:47:35:92	11	b,g	WEP	No	Good
av_guest	27:55:0F:47:29:F1	1	b,g	None	No	Good
netcafe	53:72:03:CC:5B:8E	6	b,g	WPA2-ENT	No	Good
plusnet8732	41:87:36:92:E3:F0	6	b,g	WPA2-TKIP	Yes	Good
sky82939	71:22:94:DA:3C:94	122	a,n,ac	WPA2-AES	Yes	Good
sky82939	71:22:94:DA:3C:93	1	b,g	WPA2-AES	Yes	Good
av_staff	3F:22:8D:90:43:29	1	b,g	WPA2-AES	Yes	Poor
av_train_a	27:55:0F:47:CB:82	1	b,g	WEP	No	Poor
av_guest	12:34:56:78:90:AB	1	b,g	None	No	Poor
av_guest	27:55:0F:47:99:D4	1	b,g	None	No	Poor
Belkin_f5d	00:11:50:8E:1F:9A	1	b	None	No	Poor
sparkletime	81:44:91:BF:92:32	1	b,g	WPA2-AES	Yes	Poor
netcafe	53:72:03:CC:29:65	11	b,g	WPA2-ENT	No	Poor
netcafe	53:72:03:CC:5B:8F	38	a,n,ac	WPA2-ENT	No	Poor

Table 5: Training Room B site survey results.

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ESSID	BSSID	Channel	802.11	Encryption	WPS?	Signal Strength
av_train_c	27:55:0F:47:35:92	11	b,g	WEP	No	Excellent
av_train_b	27:55:0F:47:27:31	6	b,g	WEP	No	Good
av_guest	12:34:56:78:90:AB	1	b,g	None	No	Good
Belkin_f5d	00:11:50:8E:1F:9A	1	b	None	No	Good
netcafe	53:72:03:CC:5B:8E	6	b,g	WPA2-ENT	No	Good
netcafe	53:72:03:CC:29:65	11	b,g	WPA2-ENT	No	Good
netcafe	53:72:03:CC:5B:8F	38	a,n,ac	WPA2-ENT	No	Good
sky82939	71:22:94:DA:3C:94	122	a,n,ac	WPA2-AES	Yes	Good
sky82939	71:22:94:DA:3C:93	1	b,g	WPA2-AES	Yes	Good
av_staff	3F:22:8D:90:AE:54	1	b,g	WPA2-AES	Yes	Poor
av_guest	27:55:0F:47:29:F1	1	b,g	None	No	Poor
netcafe	53:72:03:CC:29:66	46	a,n,ac	WPA2-ENT	No	Poor
plusnet8732	41:87:36:92:E3:F0	6	b,g	WPA2-TKIP	Yes	Poor

Table 6: Training Room C site survey results.

END OF SUPPORTING INFORMATION

END OF PAPER