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ST BENEDICT'S COLLEGE



SUBJECT	Information Technology Theory	DATE	June 2020
GRADE	11	MARKS	90
EXAMINER	Mrs Kench	MODERATOR	Mrs Kench
		DURATION	90 Minutes

NAME

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Jacinta wants to buy a desktop computer to complete her Law degree. The computer has the with the following specifications:

- AMD RYZEN 5 1600 (3.4GHz, 19MB Cache, 6x Cores, Turbo 3.6GHz+) CPU
- AMD A320 Micro-ATX AM4 DDR4 USB3.1 HDMI, AMD RYZEN Motherboard
- GEFORCE GT 710 2GB DirectX12 Graphics Card
- 8GB DDR4 2666MHz High Performance Gaming RAM
- 1TB HDD 7200rpm 64MB Cache High Performance Hard Drive
- 650W 80+ High Performance Power Supply
- Integrated 8 CH High Definition Sound Card
- LCD and OS Optional

QUESTION 1

HARDWARE

29 MARKS

1.1 Name the THREE parts of the processor. (3)

Registers✓, CU✓ ALU✓

1.2 What is stored in the registers in the CPU? (2)

Current instruction✓ being processed✓

1.3 If the registers are 64 bits, how does that affect the Data Bus? (1)

Data bus must be 64 bits✓

1.4 How do we know the processor in the specifications will be processing in parallel? (1)

More than one core✓

- 1.5 When Jacinta checks the specifications of her computer using the Task Manager. She discovers that her processor has 6 cores and 12 logical processors. Explain how this is possible. (2)

The CPU is hyperthreaded✓ to double the physical cores✓

- 1.6 The processor is described as Turbo 3.6GHz +.

- 1.6.1 What does GHz mean? (1)

1000 000 000 vibrations per second✓

- 1.6.2 The + implies the processor can be more than 3.6GHz. Explain how this can be achieved. (2)

The CPU is over clocked✓. The clock multiplication factor can be changed. ✓

- 1.7 The CPU described has having cache.

- 1.7.1 How much cache does this CPU have? (1)

19MB✓

- 1.7.2 Why is cache made out of SRAM? (1)

SRAM is fast and does not need to be refreshed. ✓

- 17.3 The 19MB of cache does not include level 3 cache. Explain why. (1)

Level 3 cache is on the motherboard. ✓

- 1.8 The computer has 8GB DDR4 2666MHz RAM.

- 1.8.1 What is the speed of this RAM in GHz? (1)

2.666GHz✓

1.8.2 Explain what DDR SDRAM means. (3)

Dynamic RAM – contains capacitors✓
Synchronous – refreshing takes place when there is no access from RAM✓
Double Data Rate – send data twice per clock tick✓

1.8.2 RAM is slower than the CPU. Explain how the computer deals with fetching data from a slower component. (2)

Chunks of data✓ is prefetched from RAM and stored in processor cache. ✓

1.9 The specifications describe the details of the motherboard.

1.9.1 What is a motherboard? (1)

Large printed circuit board to house components✓

1.9.2 How do you know the motherboard will be compatible with the CPU? (2)

Both✓ are AMD Ryzen✓

1.9.3 Explain how the speed of every component can be increased by overclocking. (2)

Increase the speed✓ of the system bus. ✓

- 1.10 Jacinta decides to change the hard drive to an SSD. What bus would she need to have the fastest connection to the motherboard? Explain your answer. (2)

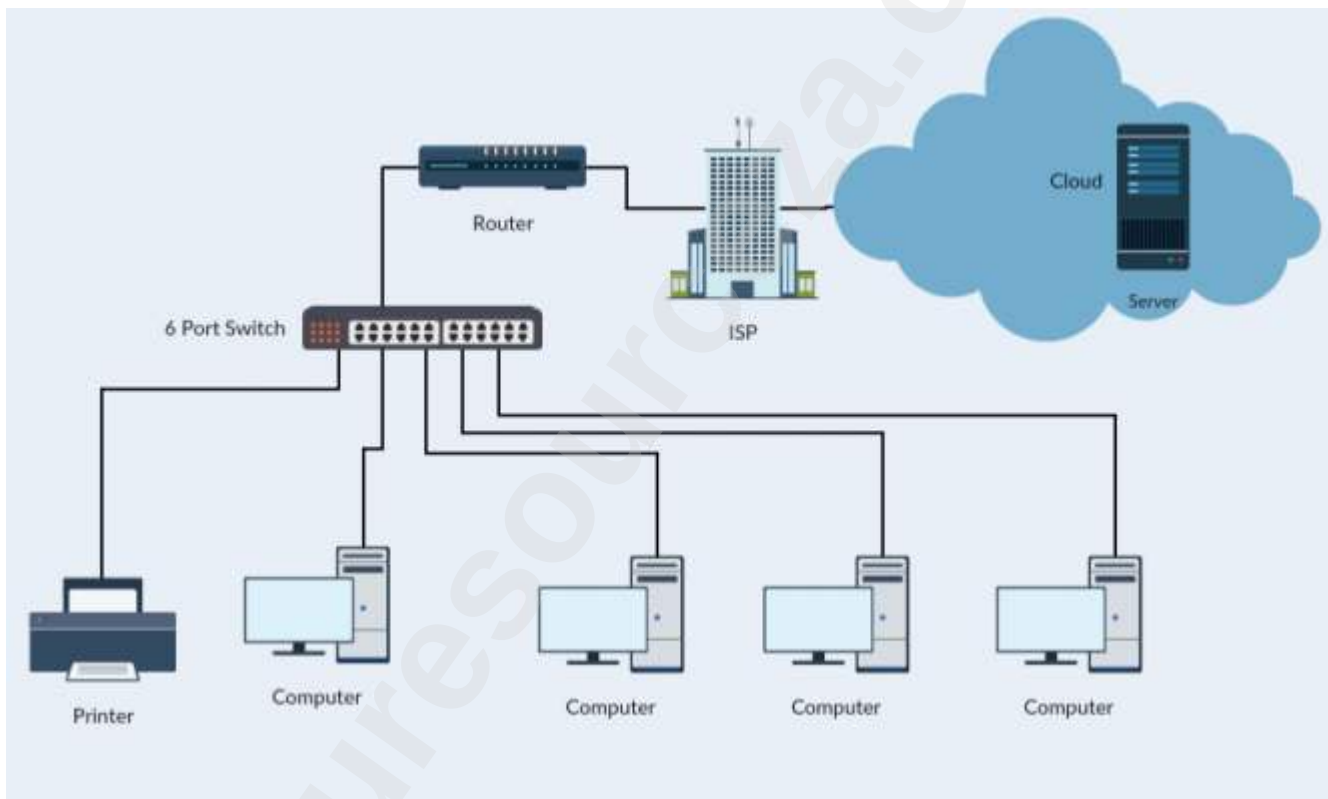
NVMe ✓ – connects to smaller devices OR provides a faster speed. ✓

QUESTION 2

NETWORKING

37 MARKS

A company has set up a LAN four computers connected to a switch which is connected to the Internet using a router. The Internet Service Provider (ISP) provide the Internet connection. The layout of the network is shown in the diagram below:



- 2.1 What is a topology? (1)

Physical layout of the network ✓

- 2.1.1 What topology is shown in the diagram? (1)

Star ✓

- 2.2 What type of cable will be used to connect the computers to the switch? (1)

UTP ✓

- 2.3. The switch will use which address (MAC or IP) to forward the frames along the network? (1)

MAC✓

2.4 Protocols:

- 2.4.1 The switch uses which protocol to resolve the MAC address to the IP address? (1)

ARP✓

- 2.4.2 What does DHCP do? Do not expand the acronym. (2)

Provides dynamic✓ IP addresses to nodes✓ on the network.

- 2.4.3 What is the name of the protocol that provides reliable connection-oriented messaging? (1)

TCP✓

- 2.4.4 Which protocol is used to send voice and sound data? (1)

VoIP or UDP✓

- 2.4.5 Which protocol is used to send emails? (1)

SMTP✓

- 2.4.6 Which protocol is used to download files? (1)

FTP or WebDav✓

- 2.4.7 Name the protocol that allows a user to read emails from many devices using the same email address. (1)

IMAP✓

2.5 Network Devices: Write down the name of the device described in the questions below:

- 2.5.1 Connect network segments wirelessly. (1)

Wireless Bridge✓

- 2.5.2 Boosts the signal of network segments. (1)

Repeater✓

2.5.3 Connects nodes of a network. (1)

Switch✓

2.5.4 Connects networks using different protocols. (1)

Gateway✓

2.5.5 Connects a node to the network using the RJ45 port. (1)

NIC✓

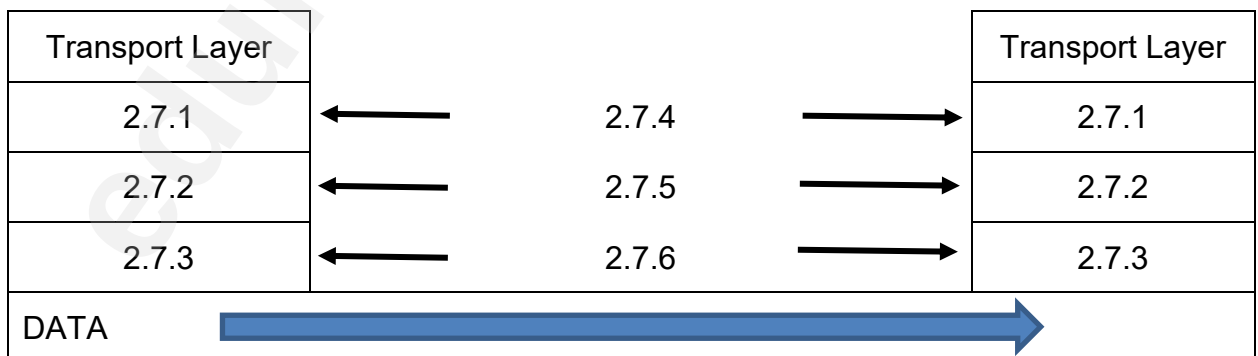
2.6 Explain how a router works by referring to packets, frames, MAC addresses and IP addresses. (4)

Router receives packets ✓ from the Internet, each packet has a sending and receiving IP address. ✓ The router adds a sending and receiving MAC address✓ to the packet to make a frame✓ and sends to the LAN.

2.7 Complete the diagram by filling in the missing devices/layers for the three lower layers of the OSI model and the associated devices.

Sending Machine

Receiving Machine



(6)

Question	Answer
2.7.1	Network✓
2.7.2	Data Link✓

2.7.3	Physical✓
2.7.4	Router✓
2.7.5	Bridge✓
2.7.6	Repeater✓

2.8 Name TWO advantages of a wireless mesh network (WMN). (2)

Advantage 1:
Less cables✓
Advantage 2:
Portable nodes✓

2.9 Fill in the missing parts of an Ethernet frame.

7 bytes	1 byte	6 bytes	6 bytes	2 bytes	42 – 1500 bytes	4 bytes	12 bytes
Preamble	Start of frame	2.9.1	2.9.2	Type	2.9.3	2.9.4	Inter-frame gap

(4)

Question	Answer
2.9.1	Dest MAC Address✓
2.9.2	Source MAC Address✓
2.9.3	Data (payload) ✓
2.9.4	CRC✓

2.10 What is a Virtual LAN (VLAN)? (2)

Logical division✓ of a physical LAN✓

2.10.1 How is an Ethernet frame adapted for a VLAN? (2)

The type part is double to 4 bytes✓ to store details of the virtual LAN ✓

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QUESTION 3 DATA REPRESENTATION & BOOLEAN LOGIC 25 MARKS

3.1 Calculate the following. Show ALL your workings:

3.1.1 $101101_2 + 11111_2$ (2)

$$\begin{array}{r} 1111\ 1 \\ 101101_2 \\ + 11111_2 \\ \hline 1001100_2 \checkmark \checkmark \end{array}$$

3.2 Express 56 in 8 bits using:

3.2.1 Sign and size (2)

$$56 = 0 \checkmark 0111000_2 \checkmark$$

3.2.2 Twos complement (1)

$$56 = 00111000_2 \checkmark$$

3.3 Express -56 in 8 bits using:

3.3.1 Sign and size (1)

$$\begin{array}{l} -56 = -00111000_2 \\ -56 = 1 \checkmark 0111000_2 \end{array}$$

3.3.2 Twos complement (2)

$$\begin{array}{r} -56 = -00111000_2 \\ = 11000111_2 \\ + \quad \quad \quad 1_2 \checkmark \\ \hline 11001000_2 \checkmark \end{array}$$

3.4 What is the largest and smallest number that can be represented in 12 signed bits? (4)

$$\begin{array}{l} \text{Largest} = 2^{12-1} - 1 \checkmark \\ = 2047 \checkmark \\ \text{Smallest} = = -2^{12-1} \checkmark \\ = -2048 \checkmark \end{array}$$

3.5 Using 5 signed bits, explain what overflow is by giving an example (2)

In 5 signed bits, the first bit is for the sign $\checkmark$. Any number larger than 01111_2 (15) will flow into the sign bit. $\checkmark$

- 3.6 Show how 23.8769453 will be represented if two digits are for the exponent and its sign and 4 digits for the mantissa and its sign. (3)

$$\begin{aligned} &23.8769453 \\ &= 0.238769453 \times 10^2 \\ &= \checkmark + 239 \checkmark \text{ E} + 2 \checkmark \end{aligned}$$

- 3.7 Use De Morgan's law to find $F'(A,B,C)$ if $F(A,B,C) = A(B+C)'$ (2)

$$\begin{aligned} &F'(A,B,C) \text{ if } F(A,B,C) = (A(B+C))' \\ &= A' \checkmark + B' \cdot C' \checkmark \end{aligned}$$

- 3.8 Use a truth table to prove:
 $F'(A,B) = (AB + A')' = (A'+B').A$ (5)

The table below may have more rows and columns than necessary.

A	B	Workings $(AB + A')'$	$(AB + A')'$	Workings $(A'+B').A$	$(A'+B').A$
0	0	$(0.0+0')'=(0+1)'$	0✓	$(0'+0').0 = (1+1).0 = 1.0$	0✓
0	1	$(0.1+0')'=(0+1)'$	0✓	$(0'+1').0 = (1+0).1 = 1.0$	0
1	0	$(1.0+1')'=(0+0)'$	1✓	$(1'+0').1 = (0+1).0 = 0.1$	1
1	1	$(1.1+1')'=(1+0)'$	0✓	$(1'+1').1 = (0+0).1 = 0.1$	0