CS2022 ASSIGNMENT 4 (Answers)

Instructions: In this assignment, there are five questions. You have to answer all of them. Put your answers in a MS WORD file, or other word processing file, and then submit the file to the course Gmail account.

Regarding Questions 5(c), 5(d) and 5(e), you could simply draw the circuits on a piece of paper. Then, you can take a photo of it and attach the image file in your answer file.

Before attaching the image in your answer file, you might need to convert its file format so that its file size is as small as possible. It is because the file size of an image could be very large if it is taken by a cell phone with very high resolution camera.

Reminder: Please double check your writing to avoid any obvious grammatical or spelling mistake.

Question 1

In the lecture note about *information systems*, it is stated that an information system is a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. The mission of an information system is to improve the performance of people in organizations through the use of information technologies.

(a) Imagine that you were living in 400 years ago. State three information systems which could be found at that time and describe what were they used for.

(b) State the information technologies which were likely used for (i) information collection, (ii) information processing, (iii) information storage and (iv) information distribution.

(c) State the information technology which was likely used for information security.

(d) With reference to today technologies, state the information technologies which are likely used for (i) information collection, (ii) information processing, (iii) information storage, (iv) information distribution and (v) information security.

(e) Explain the reason(s) why transaction processing systems are inevitable in a firm.

Answers:

(a) In 400 years ago, information systems could be found. Here describes a few of them.

A merchant would need to have an *accounting information system* to manage the cash flow information. The information included, but not limited to, (i) the amount of payment in each transaction, (ii) the name of the payer (i.e. customer) who had not settled a transaction and the amount of the payment, (iii) the name of the payee (i.e. supplier) whose transaction had not been settled and the amount of the payment.

A city government would have a *census information system* to manage the personal information of every citizen living in the city. Just like any census information system of today, the information to be collected in the system included (i) the address of the family; (ii) the name, the age and the gender of each member in the family.

Similarly, a city government would have a *taxation information system* to manage the tax payment information of every citizen living in the city.

The imperial library (resp. imperial medical library) in a palace (resp. imperial academy of medicine) would have a *library information system* which facilitated a user to search for a book or a document in it.

(b) (i) For information collection, a manual worker would have to write down the information on a paper book. So, the technologies to support information collection are the writing technique, a hair pen and a book. (ii) Information processing normally appeared in the *accounting information system*. A merchant would like to calculate the data like monthly profit. The key technology for information processing was thus the abacus. (iii) In 400 years ago, the technologies for information storage were the paper account book and the cabinet for locking the account books. (iv) For information distribution, it relied a lot on the technologies supporting the delivery of a message from one location to another. The process were realized by a human worker or an animal carrying the message to the destination location. There were three possible ways to accomplish this work. The first way was based on running or walking to the destination location. The second way was based on riding a horse to the destination location. The third way was to let a pigeon carry the message and fly to the destination location.

(c) To protect the accounting information to be leaked, a simple technology was a lock. For highly secured information, like the country map, it would be locked in a special room and further protected by security guards who were from well-trained arm force.

(d) Today, the technologies to support the above five processes are very different from the technologies in 400 years ago. (i) To facilitate information collection, an ease-to-use graphical user interface (GUI) could let a manual worker entering the information more efficient. In some applications like selling items in a shop and parcel delivery in DHL, bar code scanner is an important device for collecting information. In a warehouse, the information of all incoming shipping boxes must be collected and stored in a logistic information system. To facilitate this information collection, RFID tags and RFID readers could be used. (ii) To facilitate information processing, a computer with a database management system (DBMS) would be useful. Note that a DBMS is not simply a system for data storage. It also provides methods for programmers to write programs to access the data. Without using a DBMS for processing the information, electronic calculator would be useful for a worker to process the data manually. (iii) DBMS and file system are the key technologies for information storage. (iv) For information distribution, network technologies are the keys. Roughly speaking, Internet is a key technology. (v) In simple words, the key technology to support information security is the encryption technology. Encryption technology refers to a collection of technologies which include the secure-key technology, the asymmetry-key technology and the secure session layer (SSL) technology.

(e) It is because all raw data relevant to a firm or an organization must be collected and stored by the transaction processing system (TPS). Information like the annual operational cost and the annual revenue have to be processed based on the raw data in the TPS. These information could aid the decision information system and executive information system to make decision and compile a long-term plans for a firm or an organization. For those data which are relevant for operations management could aid the management information system to monitor the performance of the workers and the departments in a firm or an organization.

Question 2

In the video Amazon Fulfillment Center, each shipment box to the center will need to be scanned for its shipment information. The information of each item in the box will have to be scanned and input to the corresponding information system.

(a) Who shipped the boxes to the Amazon Fulfillment Center?

(b) In the video, the narrator has mentioned some exceptional cases under such the shipment box cannot be handled in a normal way. The box will have to be taken to other section for unpack. What are these exceptional cases?

(c) In improve the working efficiency of the workers, many technologies have been used. They include the bar code scanner, the corresponding information system and a sucker. However, many works still have to be done by the workers manually. What are they?

Answers:

(a) The shipping boxes are from the merchants.

(b) At least two cases have been mentioned One case is when the label regarding the shipping box information is not tapped properly. The second case is when multiple items in a box were packed together as one piece and they were shared with one item label.

(c) (i) Worker has to take each box from the floor to the working bench. (ii) Each box has to be unsealed manually. (ii) The labels on a shipping box has to be scanned by a worker manually.

Question 3

(a) With reference to the ASCII table, how many bits are needed for encoding "John Sum"? Note that the open and close quotations are not included and there is a space between "John" and "Sum".

(b) What is the binary pattern for "John Sum"?

(c) What is the binary pattern for the equation "$3+x = 7$"? Note that there is no space in this equation.

(d) To encode an Asian language character, how many bits are needed?

Answers:

(a) 8 bytes.

(b) For the binary pattern, it is too long to be put in here. Only the hexdecimal code is given. The code for "John Sum" is "4A6F686E20537568".

(c) The hexdecimal for "3+x=7" is "332B783D37".

(d) 16 bits.

Question 4

(a) Convert the positive integer 1088_{10} (in decimal format) to 16-bit unsigned integer format.

(b) Convert the positive integer 11088_{10} (in decimal format) to 16-bit unsigned integer format.

(c) For a solid state drive (SSD) with 500GB, what is its actual memory size?

(d) Follow (c), what is the minimum number of bits for indexing all the memory slots in the SSD?

(e) If the memory address of the first memory slot is indexed as all zeros, what is the index (in decimal format) of the last memory slot?

Answers:

(a) 0000010001000000.

(b) 0010101001010000.

(c) $512 \times 2^{30} = 2^{39}$ bytes.

(d) 39 bits.

(e) $2^{39} - 1$.

Question 5

(a) State the truth tables for the logic gates, AND, OR, NAND, NOR and XOR. Here, it is assumed that these logic gates are two-input-one-output logic circuits. The inputs of each logic gate are denoted as X and Y. The output is denoted as Z.

(b) State the truth table for the NOT gate. Its input is denoted as X and its output is denoted as Z. Moreover, draw a logic circuit which implements an AND gate by two NAND gates.

(c) The following is the truth table of a digital logic circuit.

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	1

You are allowed to select any one of the logic gates mentioned in (a) and (b). Design a logic circuit its operation conforming to the above truth table.

(d) The following is the truth table of a digital logic circuit.

X	Y	Z
0	0	0
0	1	0
1	0	1
1	1	0

You are allowed to select any one of the logic gates mentioned in (a) and (b). Design a logic circuit its operation conforming to the above truth table.

(e) The following is the truth table of a digital logic circuit.

X	Y	Z
0	0	1
0	1	0
1	0	1
1	1	1

You are allowed to select any one of the logic gates mentioned in (a) and (b). Design a logic circuit its operation conforming to the above truth table.

Answers:

(a) Their truth tables are listed below.

AND

X	Y	Z
0	0	0
0	1	0
1	0	0
1	1	1

OR

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

NAND

X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

NOR

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

XOR

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

(b) The truth table is shown below.

X	Z
0	1
1	0

(c) To be released in the make-up class.

(d) To be released in the make-up class.

(e) To be released in the make-up class.