选择题 ? ✗.

Section B Short Questions (40 marks)

Answer ALL FOUR questions in this section. Write down your answers in the provided answer book.

Question 11. [10 marks]

(a) Prove that if a and b are integers, and $a + b \geq 15$, then $a \geq 8$ or $b \geq 8$. (4 marks)

(Hint: first, consider the problem in the form of $p \to q$)

(a). Let prove by contradiction
if $a < 8$ and $b < 8$, which means
$a \leq 7$, and $b \leq 7$,
then $a + b \leq 14$,
which makes contradiction

(b) Prove that, the inequality $2^n \leq 2^{n+1} - 2^{n-1} - 1$ holds for each $n \in \mathbb{N}$. (6 marks)

$2^{n+1} = 2^n + 2^n - 2^n + 2^{n-1} + 2^{n-1} \geq 2^n + 2^{n-1} + 1$.

$2^{n-1} \geq 1$ ☆ when $n \geq 1$ 正整数

Question 12. [10 marks]

(a) Given the letter p to represent the statement "study hard," and q for "go to party," Translate the following statements into symbols:

i) The weather is neither study hard nor go to party (2 marks) $(\neg p) \wedge (\neg q)$

ii) I can study hard, or I can go to parties, but I cannot study hard and go to parties (2 marks)
$(p \vee q) \wedge [\neg (p \wedge q)]$

(b) From the following premises show that $\neg p$ is a conclusion: (6 marks)

1. $(p \to q) \vee r$
2. $\neg r$

少 3. $\neg q$条件?

∵ $\neg r$, $(p \to q) \vee r$
∴ $p \to q$
∵ $\neg q$
∴ $\neg p$.

Question 13. [10 marks]

How many bits may be required for encoding the message 'mississippi'? 没学
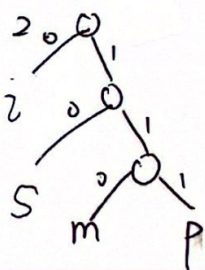
(Hint: the suggested solving steps is as below:

1. Determine the frequency table of characters.
2. Generate the Huffman tree.
3. Deduce the code and code length of each character.
4. Calculate the number of bits to be used to encode the message.)

1. frequency
   m : 1
   p : 2
   s : 4
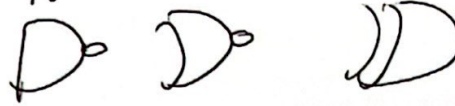   i : 4

3. i : 0
   s : 10
   m : 110
   p : 111

4. $4 \cdot 1 + 4 \times 2 + 2 \cdot 3 + 1 \times 3$
   $= 4 + 8 + 6 + 3$
 $= 21$.

(i) (s) (p) (m) 12 + 9.

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N N^e

Question 14. [10 marks]

As an example of a combinational circuit, we learnt the logic of a half adder in Lecture 12. By connecting two half-adders, a full adder circuit is constructed. A complete adder includes three binary digit inputs (two input bits and one carry input bit), as well as two binary digit outputs: the sum bit (S) and the carry output bit (Cout):

作业题?

用 boolean algebra 而不是 logic ?
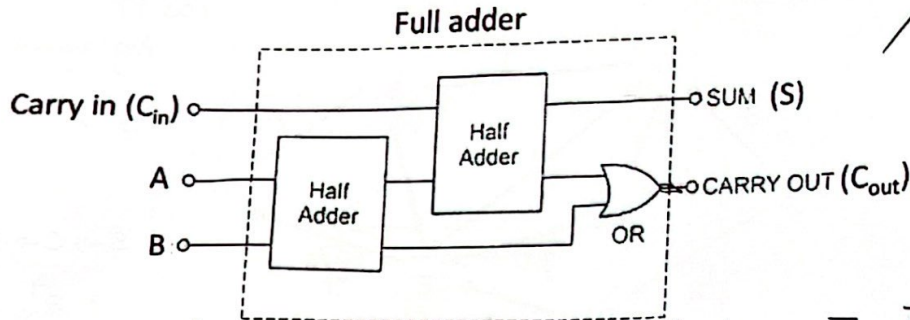
(a) Determine the truth table of a full adder logic. (4 marks)

(b) Determine the logic of Sum output bit of a full adder. (2 marks)

(c) Determine the logic of Carry output bit of a full adder. (2 marks)

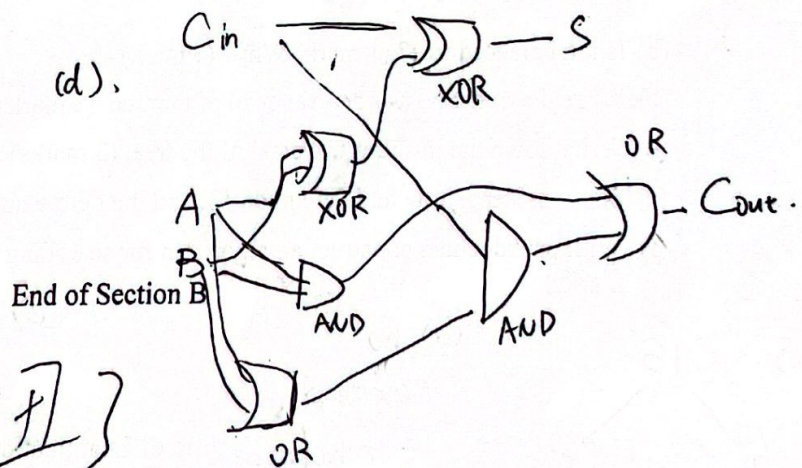(d) Draw the combinational circuit of the full adder. (2 marks)

是这样吗

(b) $S = A \oplus B \oplus C_{in} = (A \oplus B) \oplus C_{in}$

(c) $C_{out} = AB + BC + AC$
$= AB + C(A+B)$

(a).

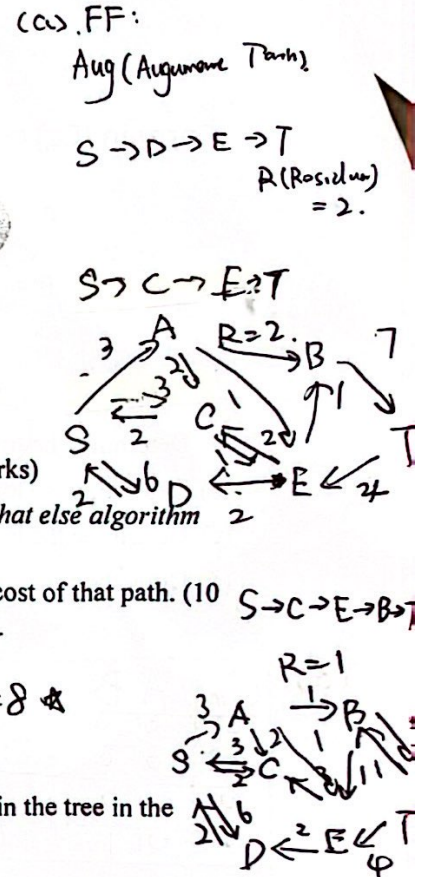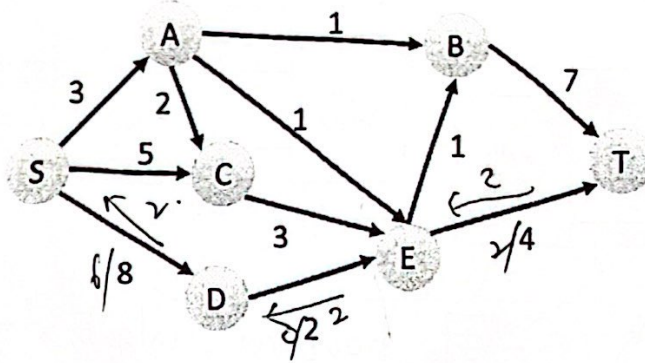| C_{in}	A	B	S	C_{out}
0	0	0	0	0
1	0	0	1	0
0	1	0	1	0
0	0	1	1	0
1	1	0	0	1
0	1	1	0	1
1	0	1	0	1
1	1	1	1	1

(d).

End of Section B

太扣了

6

Section C Long Questions (40 marks)

Answer **ALL TWO** questions in this section. Write down your answers in the provided answer book.

Question 15. [20 marks]

Consider the following graph G:

[Handwritten graph G with nodes A, B, S, C, T, D, E and edge weights: A→B = 1, S→A = 3, S→A = 2, A→C = 5, A→E = 1, B→T = 7, E→T = 1, C→E = 3, S→D = 6/8, D→E = 6/2 2, E→T = 2, 2/4]

[Handwritten solution for (a) FF:]
(a). FF:
Aug (Augument Path)
S→D→E→T
R (Residue) = 2.
S→C→E→T
3 A R=2 →B 7
S 2 C 2 →E T
2 6 D →E 2
S→C→E→B→T R=1
3 A →B
S →C
2 6 D→E→T 4

(a) Find the maximum flow in *G* with the aid of its residual networks. (10 marks)

(Note: You are not allowed to use the max-flow/min-cut algorithm, then what else algorithm you can use?) *[Chinese handwriting]*

(b) From the above graph *G*, determine the shortest path from S to T and the cost of that path. (10 marks)

[Handwritten (b):]
$d_S = 0$
$d_A = 3$ $d_C = 5$ $d_D = 8$
$d_A = 3$
$d_B = \infty$ $d_E = 4$
$d_E = 4$ $d_C = 5$
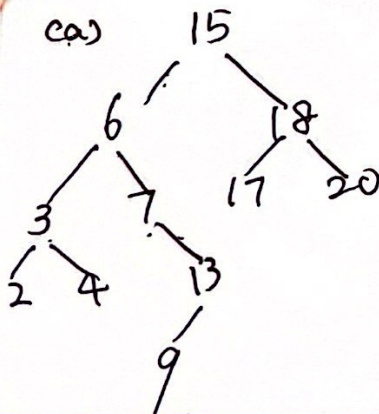$d_T = 8$ $d_T = 8$
$d_B = 4$
S→C→E→B→T

Question 16. [20 marks]

(a) Draw the binary search tree created if the following numbers are inserted in the tree in the given order. (4 marks)

$$15 \ 6 \ 18 \ 3 \ 7 \ 17 \ 20 \ 2 \ 4 \ 13 \ 9$$

(b) Is it a balanced tree? (1 mark) Why? (1 mark)

(c) Write down the post-order traversal of the tree. (3 marks)

(d) Write down the in-order traversal of the tree. (3 marks)

(e) Show in steps, how to delete node 13, and the delete node 15 of the tree. (3 marks)

(f) With pseudocode, construct an algorithm for searching the maximum value of the tree. (5 marks)

[Handwritten (f):]
(f) P ← root node S→A→B→T
while p has right son R=1
P ← p's right son max flow = 6
return P. value

[Handwritten (a) tree:]
(a) 15
6 18
3 7 17 20
2 4 13
9

(b) no
maxdeep
− mindeep
= $d_9 - d_{17}$
= 4−2 = 2 > 1

End of Examination

(c). 2 4 3 9 13 7 6 17 20 18 15

(d). 2 3 4 6 7 9 13 15 17 18 20

(e). delete 13 and replace it with 9.
delete 15, find successor of 15: 17.
replace
17
6 18
3 7 9 20