

BAMS1633 FURTHER DISCRETE MATHEMATICS

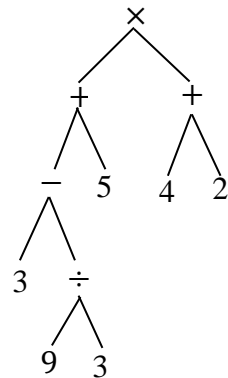
Academic year 2021/22

Session 202201

Q1. a) 30

$$((3 - (9 \div 3)) + 5) \times (4 + 2)$$

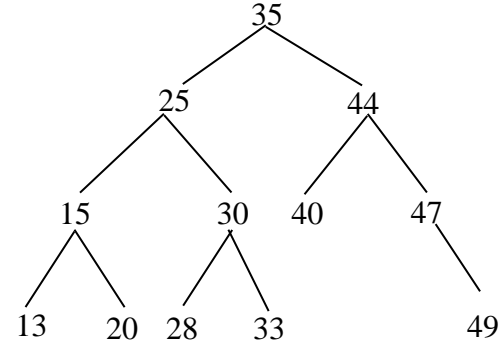
Binary tree



Postorder: 3 9 3 ÷ - 5 + 4 2 + ×

[Total: 8 marks]

Q1. b) (i)

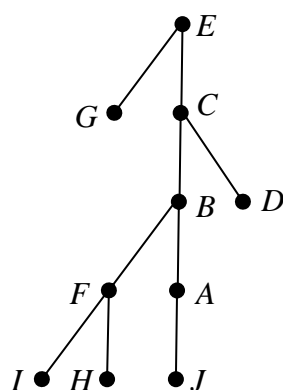


(ii) Preorder: 35 25 15 13 20 30 28 33 44 40 47 49

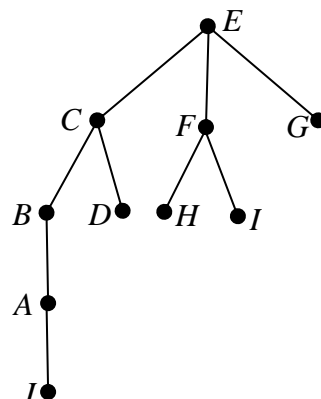
(iii) Expected number of comparisons = 3.0833

[Total: 7 marks]

Q1. c) Depth-first search



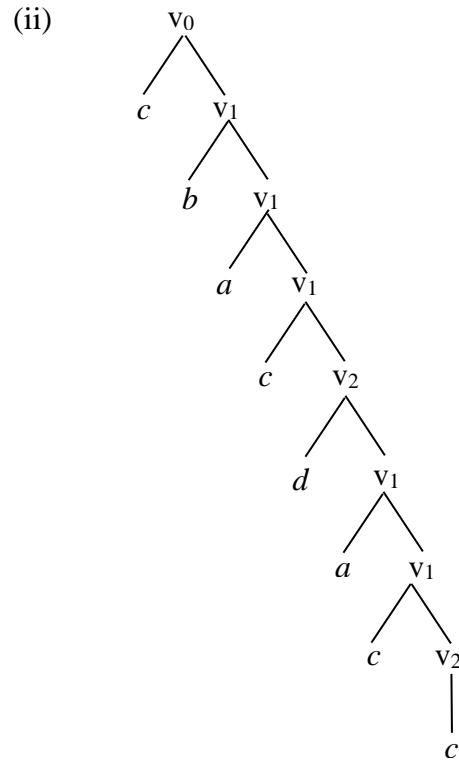
Breadth-first search



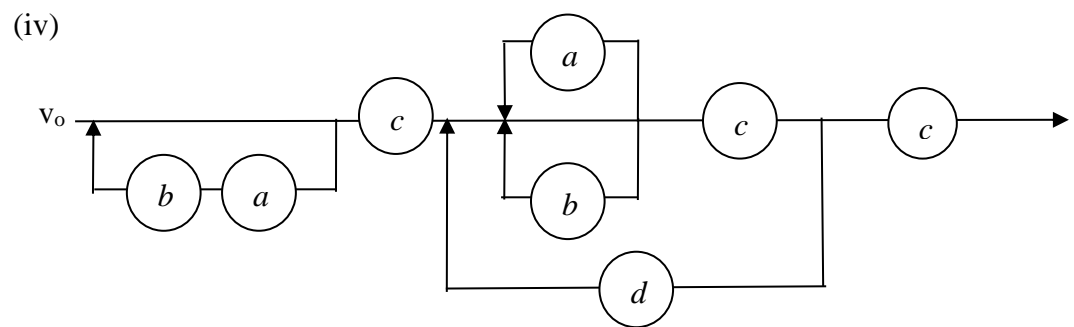
[Total: 10 marks]

BAMS1633 FURTHER DISCRETE MATHEMATICS

- Q2. a) (i) $\langle v_0 \rangle ::= ab\langle v_0 \rangle \mid c\langle v_1 \rangle$
 $\langle v_1 \rangle ::= a\langle v_1 \rangle \mid b\langle v_1 \rangle \mid c\langle v_2 \rangle$
 $\langle v_2 \rangle ::= d\langle v_1 \rangle \mid c$



- (iii) $abcbacdc$ is not a syntactically correct sentence.



- (v) Regular expression = $(ab)^*c(a \vee b)^*c(d(a \vee b)^*c)^*c$

[Total: 15 marks]

BAMS1633 FURTHER DISCRETE MATHEMATICS

Q2. b) (i) State transition table of M

	0	1
S_0	S_4	S_4
S_1	S_4	S_3
S_2	S_2	S_4
S_3	S_4	S_1
S_4	S_4	S_0
S_5	S_1	S_3

(ii)

	S_1	S_3	S_2	S_5	S_0	S_4
0	S_4	S_4	S_2	S_1	S_4	S_4
1	S_3	S_1	S_4	S_3	S_4	S_0

(iii) State transition table of M/R

	0	1
$[S_0]$	$[S_0]$	$[S_0]$
$[S_1]$	$[S_0]$	$[S_1]$
$[S_2]$	$[S_2]$	$[S_0]$
$[S_5]$	$[S_1]$	$[S_1]$

(iv) 101101 is accepted by both M and M/R .

[Total: 10 marks]

Q3. a) (i) Commutative and associative.

(ii) Let e be the identity element.

$$e = \frac{3}{2} \in \mathbb{Q} - \{0\}.$$

(iii) Let I be the inverse of r .

$$r = \frac{9}{4r} \in \mathbb{Q} - \{0\}.$$

[Total: 19 marks]

BAMS1633 FURTHER DISCRETE MATHEMATICS

- Q3. b) (i) T is not closed under addition.
- (ii) T is closed under multiplication.

[Total: 6 marks]

- Q4. a) (i)

w	e(w)
00	00000
01	01111
10	10011
11	11100

- (ii)

Syndrome	Error
000	00000
001	00001
010	00010
100	00100
111	01000
011	10000
110	00110 or 01001
101	00101 or 01010

- (iii) 11

[Total: 9 marks]

BAMS1633 FURTHER DISCRETE MATHEMATICS

Q4. b) (i)

Letter, (x_i)	r	a	m	y	p	i	s	b
Probability, $P(x_i)$	0.12	0.25	0.15	0.02	0.11	0.24	0.08	0.03
Codeword, C_i	110	01	000	00111	111	10	0010	00110

(ii) Average code length, $L(C) = 2.69$ bits

Entropy, $H(x) = 2.6782$

Efficiency = 0.9956

The efficiency of this code is 99.56%.

[Total: 16 marks]