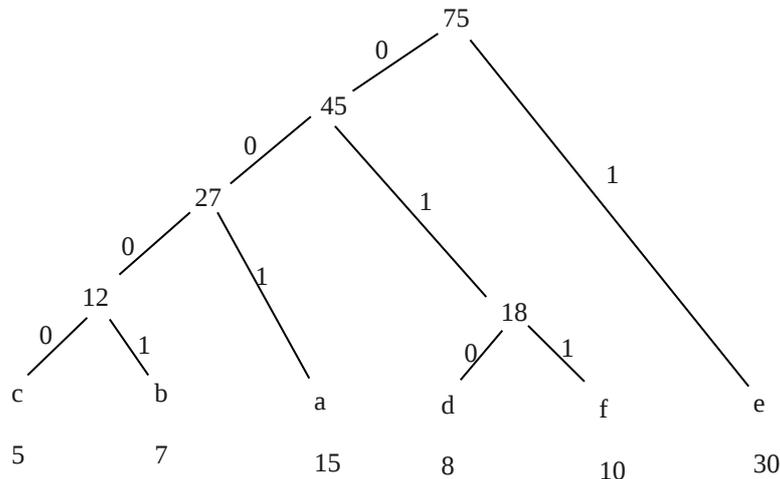


Compression

1. **N.B.** One possible Huffman tree is given below. Your solution may well be different: you can check that it's correct (i.e. optimal) by comparing the lengths of the codes given: b and c should have long (4-bit) codes a, d and f should have medium-length (3 bit) codes and e should be a short (1 bit) code. Of course the remaining parts of the question (encoding, decoding and compression ratios) will all depend on your tree

a)



b) So codes are

e =	1	d =	010
a =	001	b =	0001
f =	011	c =	0000

c) Use the tree to compress the following strings:

- i) 'faded' 0110010101010
 ii) 'abed' 00100011010
 iii) 'feed' 01111010

d) Compression ratios:

- i) Original = $5 \times 16 = 80$ bits
 Compressed = 13 bits
 Compression ratio = 6.15
- ii) Original = $4 \times 16 = 64$ bits
 Compressed = 11 bits
 Compression ratio = 5.8
- iii) Original = $5 \times 16 = 80$ bits
 Compressed = 8 bits
 Compression ratio = 10
- iv) String (c) because it contains a high proportion of common characters, in particular 'e'.

2. **N.B.** A key learning objective of this course, assessed in examinations, is that you are able to write Java code to express an algorithm or manipulate a data structure. You must practice this skill.

a)

```

public char decompress(String s, BinaryTreeNode b)
{
    if (b.isLeaf())
        return b.element;
}
  
```

```

else
  if (s.charAt[0] == '0')
    return decompress(s.substring(1),b.leftChild);
  else
    return decompress(s.substring(1),b.rightChild);
}

```

3.

a) Dictionary:

0	1	2	3	4	5	6	7	8	9	10	11
E	T	W	_	TW	WE	EE	ET	T_	_T	TWE	EET

b) Code: 120013461

4. Using the dictionary from question 3 above, uncompress the following string:
2013468

Show the dictionary and the uncompressed string after

i) the first code has been uncompressed

W	0	1	2	3	4
	E	T	W	_	WE

ii) the second code has been uncompressed

WE	0	1	2	3	4	5
	E	T	W	_	WE	ET

iii) the fourth code has been uncompressed

WET_	0	1	2	3	4	5	6	7
	E	T	W	_	WE	ET	T_	_W

iv) the entire string has been uncompressed.

WET_WET_WET	0	1	2	3	4	5	6	7	8	9
	E	T	W	_	WE	ET	T_	_W	WET	T_W

5. a) What ISO MPEG standards exist and what are their capabilities?

MPEG-1: poor video quality

MPEG-2: higher quality DVD ROM/TV quality

MPEG-4: interactivity, mobile devices

b) Is MPEG a lossy compression method? If so, carefully explain what data is lost.

MPEG is lossy. It uses JPEG to compress frames, and JPEG transforms an image to obtain the spatial frequencies, and then saves space by discarding the high spatial frequency data corresponding to fine detail in the image.

There's a lot more info on the web: try a search for JPEG or MPEG