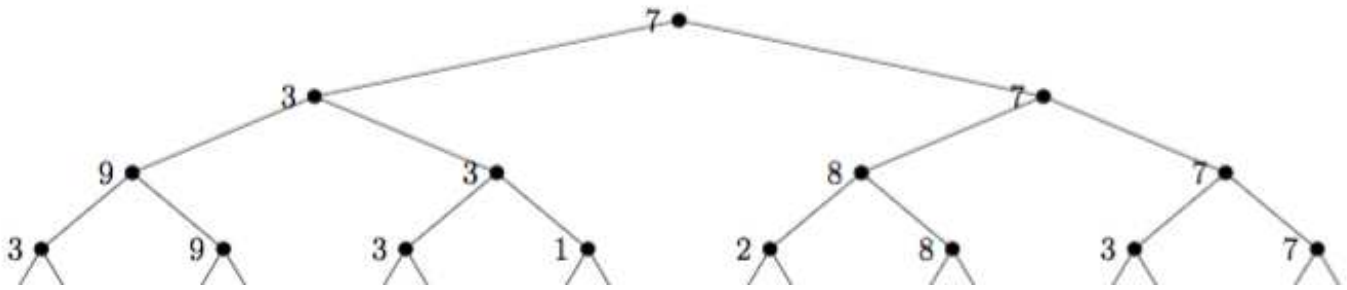
2. [4 marks]

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	A	B	C	D	E
5	5	4	8	5	7	4	7	8	7	3	2	5	7	4	1	2	7	8	9	2	7	1	3	7	7	6	0	3	5	7

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	A	B	C	D	E
5	-5	-4	8	5	7	4	7	-8	-7	-3	-2	-5	-7	-4	-1	-2	-7	8	9	2	7	1	3	7	-7	-6	0	-3	-5	-7

3. [2 marks] Alpha-beta did not cut off any branches, so each node is labelled with its final minimax value.



4. [2 marks] Any permutation of X moves `(4 * 8 * 2 *)` and/or any permutation of O moves `(* 5 * 7 * 3)` gives a transposition, so there are many correct answers. E.g. switch first two X-moves: 1.X[8] 2.O[5] 3.X[4] 4.O[7] 5.X[2] 6.O[3] (8 5 4 7 2 3)

   Here is the original position and all isomorphic copies.

```
. x o     . x o   . x o   . . o   . . o   o x .   o x .   o . .   o x .
x o .     x o x   . o x   x o x   x o x   x o x   . o x   x o x   x o .
o x .     o . .   o x .   o x .   o x .   . . o   . x o   . x o   . x o
```

5. [1 marks] There is a 1-1 correspondence between positions and sequences of 9 characters x/o/-. There are 3^9 such sequences, so there are 3^9 different positions. Not all positions are reachable, e.g. any position with a winning condition for both x and o is not reached, so the number of table entries is less than 3^9. (If your transposition table uses isomorphism, the table is even smaller, as the next question shows.)

6. [2 marks] In the lines `for cell in A` (197, 251), replace `A` with `L`. 18777 3463 3025 1239

7. [3 marks] X wins. `genmove` from this position gives 3.X[c3] as winning move with smallest number of nodes explored, so try that move. Resulting proof tree is below.