



Oxford Cambridge and RSA

Thursday 21 October 2021 – Afternoon

A Level Further Mathematics A

Y544/01 Discrete Mathematics

Printed Answer Booklet

Time allowed: 1 hour 30 minutes



You must have:

- Question Paper Y544/01 (inside this document)
- the Formulae Booklet for A Level Further Mathematics A
- a scientific or graphical calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided in the **Printed Answer Booklet**. If you need extra space use the lined pages at the end of the Printed Answer Booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give non-exact numerical answers correct to **3** significant figures unless a different degree of accuracy is specified in the question.
- The acceleration due to gravity is denoted by $g \text{ m s}^{-2}$. When a numerical value is needed use $g = 9.8$ unless a different value is specified in the question.

INFORMATION

- The total mark for this paper is **75**.
- The marks for each question are shown in brackets [].
- This document has **16** pages.

ADVICE

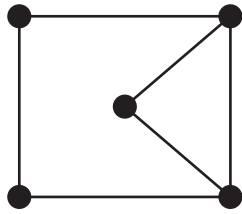
- Read each question carefully before you start your answer.

1(a)	Bag 1:
	Bag 2:
	Bag 3:
	Bag 4:
	Bag 5:
1(b)	
1(c)	

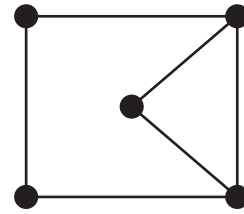
2(a)(i)																							
2(a)(ii)																							
2(b)																							
1.																							
2.																							
2(c)	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 15%; text-align: center;">J</td> <td style="width: 15%; text-align: center;">K</td> <td style="width: 15%; text-align: center;">L</td> <td style="width: 15%; text-align: center;">M</td> <td style="width: 15%; text-align: center;">N</td> </tr> <tr> <td style="text-align: left;">Indegree</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: left;">Outdegree</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						J	K	L	M	N	Indegree						Outdegree					
	J	K	L	M	N																		
Indegree																							
Outdegree																							
2(d)(i)																							
2(d)(ii)																							

4(a)	Graph	is not isomorphic to $K_{2,3}$
	because	
4(b)		
4(c)		

4(d)



SPARE COPY



4(e)

4(f)

4(g)

4(h)

5(a)

		Beth		
		X	Y	Z
Alex	P	x	3	2
	Q	4	0	-2
	R	-3	-1	-3

(i) Stable when

(ii) Unstable when

5(b)

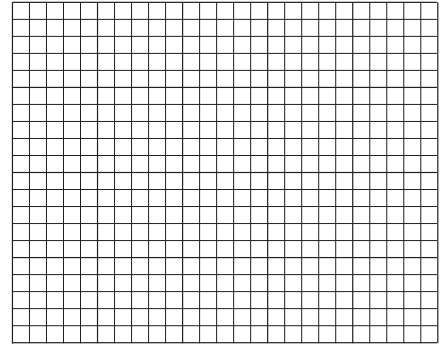
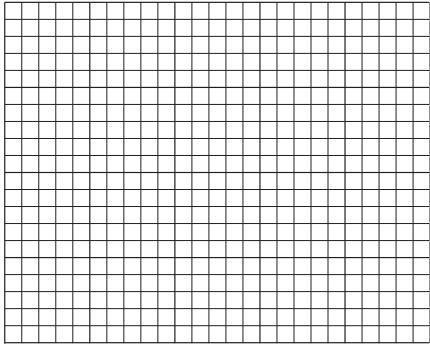
X	Y	Z

5(c)

(answer space continued on next page)

5(c) (continued)

For working, if required.



5(d)

6(a)

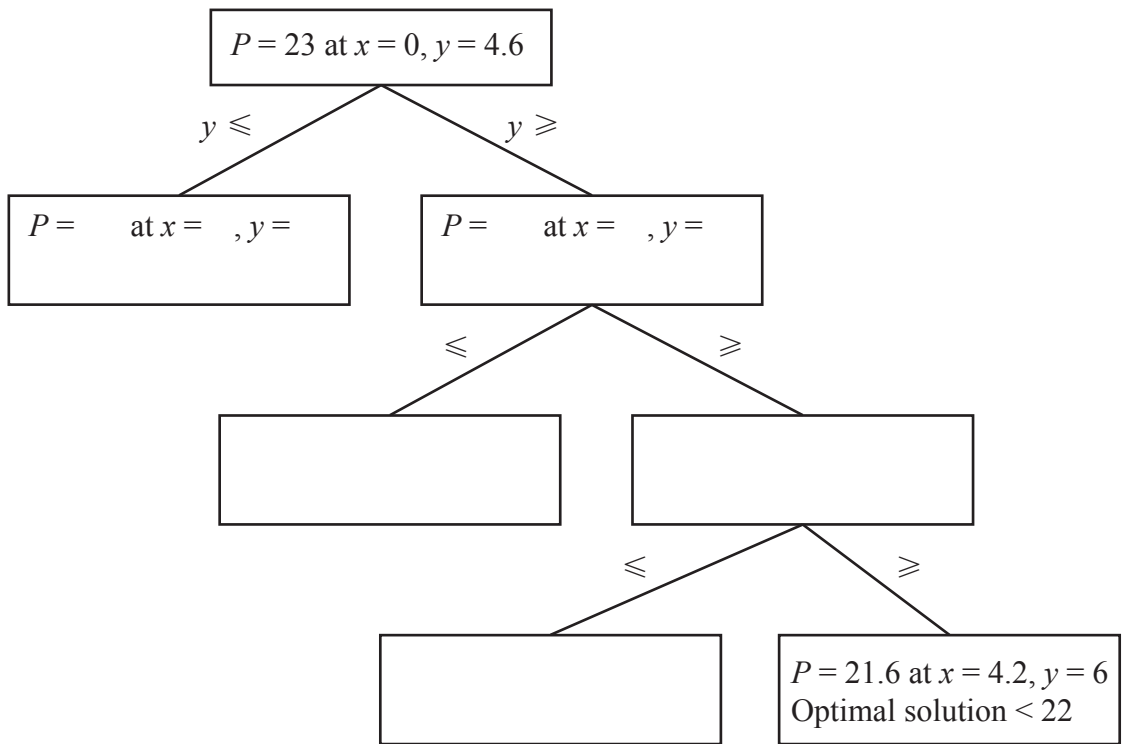
P	x	y	s	t	u	RHS
1	2	-5	0	0	0	0
0	2	1	1	0	0	25.8
0	-1	3	0	1	0	13.8
0	4	-3	0	0	1	18.8

Maximise $P =$

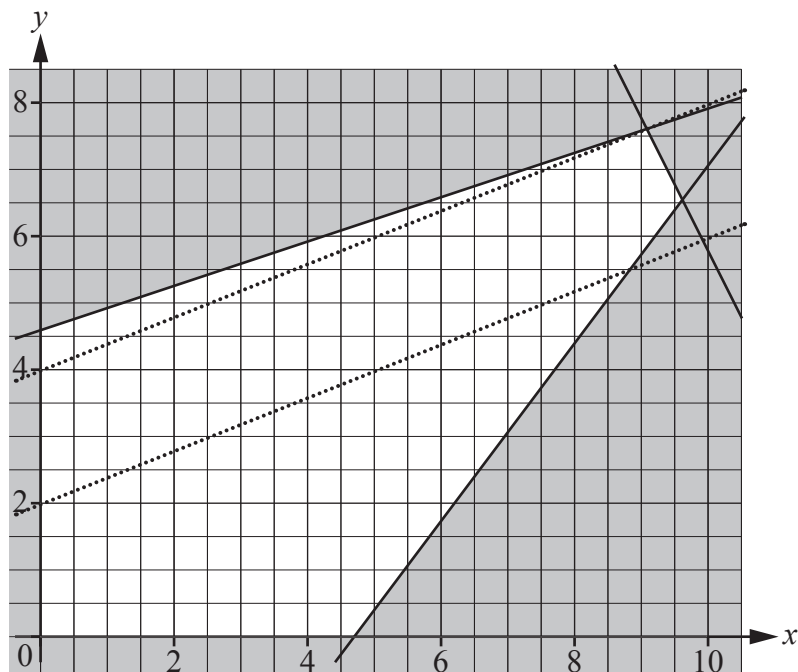
Subject to

and $x \geq 0, y \geq 0$

6(b)



For working, if required (there is another copy of this graph on the next page).



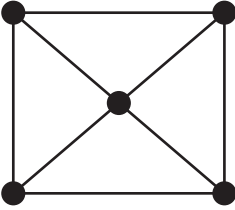
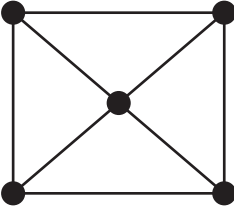
An optimal solution to the constrained problem is

$P =$ when $x =$ and $y =$

(answer space continued on next page)

7(a)(i)	BUBBLE SORT								
	Original list:	2.9	0.9	1.5	3.5	4.2	5.3	4.7	2.3
	After 1st pass:								
	After 2nd pass:								
7(a)(ii)	SHUTTLE SORT								
	Original list:	2.9	0.9	1.5	3.5	4.2	5.3	4.7	2.3
	After 1st pass:								
	After 2nd pass:								
7(b)									

7(c)(i)	Sorted list: 0.9 1.5 2.3 2.9 3.5 4.2 4.7 5.3

7(c)(ii)		SPARE COPY 
	Total weight of minimum spanning tree:	

7(c)(iii)	

7(c)(iii)	

