



Oxford Cambridge and RSA

**Wednesday 22 June 2022 – 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)

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Last name

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**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.

**BLANK PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**

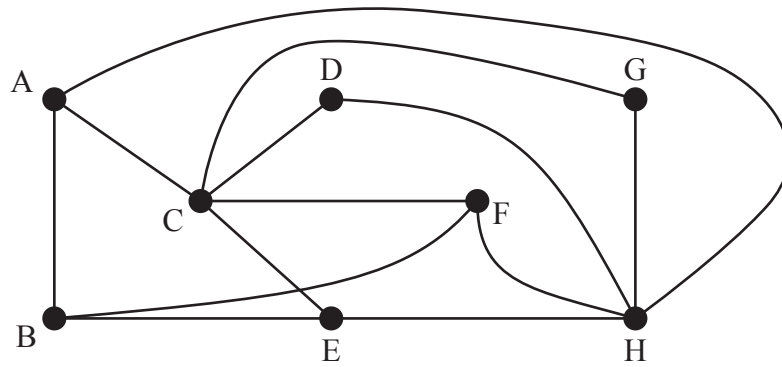
<b>1(a)</b>											
<b>1(b)</b>	<table border="1"><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>										
<b>1(c)</b>	<table border="1"><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>										

<b>2(a)</b> <b>2(b)</b>	
	Minimum project completion time = _____ minutes
<b>2(c)</b>	

<b>3(a)</b>	
<b>3(b)</b>	
<b>3(c)</b>	
<b>3(d)</b>	
<b>3(e)</b>	

<b>4(a)</b>	
<b>4(b)</b>	
<b>4(c)</b>	
<b>4(d)</b>	

4(e)



Output:

4(f)

4(g)

<b>5(a)</b>	<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td colspan="2"></td> <td colspan="3" style="text-align: center;">Player 2</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td rowspan="3" style="vertical-align: middle; padding-right: 10px;">Player 1</td> <td style="text-align: center; padding-right: 5px;">A</td> <td style="text-align: center;">(6, 0)</td> <td style="text-align: center;">(1, 7)</td> <td style="text-align: center;">(5, 6)</td> </tr> <tr> <td style="text-align: center; padding-right: 5px;">B</td> <td style="text-align: center;">(9, 4)</td> <td style="text-align: center;">(2, 6)</td> <td style="text-align: center;">(8, 1)</td> </tr> <tr> <td style="text-align: center; padding-right: 5px;">C</td> <td style="text-align: center;">(6, 8)</td> <td style="text-align: center;">(1, 3)</td> <td style="text-align: center;">(7, 2)</td> </tr> </table>			Player 2					X	Y	Z	Player 1	A	(6, 0)	(1, 7)	(5, 6)	B	(9, 4)	(2, 6)	(8, 1)	C	(6, 8)	(1, 3)	(7, 2)
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		X	Y	Z																				
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	C	(6, 8)	(1, 3)	(7, 2)																				
	Play-safe strategy for player 1 is																							
	Play-safe strategy for player 2 is																							
<b>5(b)</b>																								
<b>5(c)</b>	<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td colspan="2"></td> <td colspan="3" style="text-align: center;">Player 2</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td rowspan="3" style="vertical-align: middle; padding-right: 10px;">Player 1</td> <td style="text-align: center; padding-right: 5px;">A</td> <td style="text-align: center;">(6, 0)</td> <td style="text-align: center;">(1, 7)</td> <td style="text-align: center;">(5, 6)</td> </tr> <tr> <td style="text-align: center; padding-right: 5px;">B</td> <td style="text-align: center;">(9, 4)</td> <td style="text-align: center;">(2, 6)</td> <td style="text-align: center;">(8, 1)</td> </tr> <tr> <td style="text-align: center; padding-right: 5px;">C</td> <td style="text-align: center;">(6, 8)</td> <td style="text-align: center;">(1, 3)</td> <td style="text-align: center;">(7, 2)</td> </tr> </table>			Player 2					X	Y	Z	Player 1	A	(6, 0)	(1, 7)	(5, 6)	B	(9, 4)	(2, 6)	(8, 1)	C	(6, 8)	(1, 3)	(7, 2)
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<b>5(d)(i)</b>	
	$p =$
<b>5(d)(ii)</b>	
	Player                      expects to win the greater number of points when player 1 chooses B

<b>6(a)(i)</b>								
	<i>P</i>	<i>x</i>	<i>y</i>	<i>z</i>	<i>s</i>	<i>t</i>	<i>u</i>	RHS
<b>6(a)(ii)</b>								
	<i>P</i>	<i>x</i>	<i>y</i>	<i>z</i>	<i>s</i>	<i>t</i>	<i>u</i>	RHS
	Spare tableau (if required)							
	<i>P</i>	<i>x</i>	<i>y</i>	<i>z</i>	<i>s</i>	<i>t</i>	<i>u</i>	RHS

<b>6(b)(i)</b>	
<b>6(b)(ii)</b>	$x =$
	$y =$
	$z =$
<b>6(b)(iii)</b>	
<b>6(c)</b>	
<b>6(d)</b>	

7(a)

7(b)

A •

C •

F •

B •

D •

G •

E •

B	C	D	E	F	G

7(c)


<b>7(d)</b>	
	seconds
<b>7(e)(i)</b>	
	Lower bound = metres
<b>7(e)(ii)</b>	
	Upper bound = metres
<b>7(e)(iii)</b>	
	Length of shortest possible tour = metres





