

## Tuesday 3 June 2025 – Afternoon

# AS Level Further Mathematics B (MEI)

# Y413/01 Modelling with Algorithms

Printed Answer Booklet

**Time allowed: 1 hour 15 minutes**

**You must have:**

- Question Paper Y413/01 (inside this document)
- the Formulae Booklet for Further Mathematics B (MEI)
- a scientific or graphical calculator

# AB



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

## 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 page 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 your final answers to a degree of accuracy that is appropriate to the context.

## INFORMATION

- This document has **12** pages.

## ADVICE

- Read each question carefully before you start your answer.

1

|   | A  | B  | C  | D  | E | F | G  | H  | I | J  |
|---|----|----|----|----|---|---|----|----|---|----|
| A |    | 12 | 6  |    | 7 |   | 8  |    |   | 2  |
| B | 12 |    | 5  | 14 |   | 9 |    |    |   |    |
| C | 6  | 5  |    |    |   |   | 10 |    |   | 7  |
| D |    | 14 |    |    |   |   |    | 3  |   | 8  |
| E | 7  |    |    |    |   | 6 |    |    | 4 | 9  |
| F |    | 9  |    |    | 6 |   |    |    |   |    |
| G | 8  |    | 10 |    |   |   |    |    | 5 |    |
| H |    |    |    | 3  |   |   |    |    |   | 11 |
| I |    |    |    |    | 4 |   | 5  |    |   |    |
| J | 2  |    | 7  | 8  | 9 |   |    | 11 |   |    |

Order of arcs:

Total length of arcs in MST:

[illegible]

3(a)

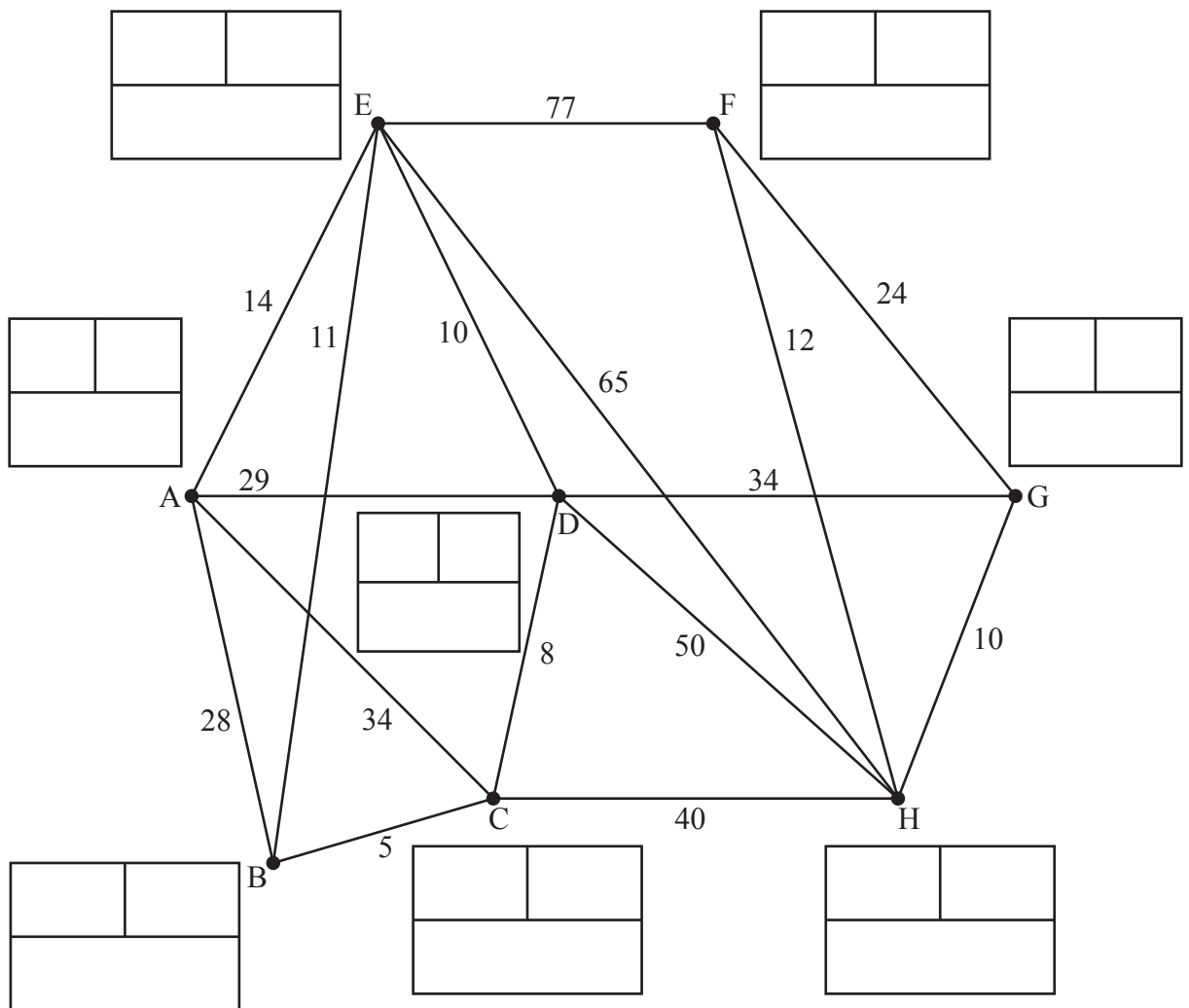
3(b)(i)

Key:  
 Order of labelling → 

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 ← Label  
 Working values (do not cross out) → 

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Length of shortest route from F to C via A:

3(b)(ii)

[illegible]

|                 |                                                                                                                                                                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>5(a)</b>     |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(b)</b>     |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(c)</b>     |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(d)(i)</b>  |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(d)(ii)</b> |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(e)(i)</b>  | <pre> graph LR     S((S)) --&gt; A((A))     S --&gt; B((B))     S --&gt; C((C))     S --&gt; D((D))     S --&gt; E((E))     S --&gt; F((F))     A --&gt; D     B --&gt; D     B --&gt; F     C --&gt; D     C --&gt; F     D --&gt; E     E --&gt; T((T))     F --&gt; T   </pre> |
|                 |                                                                                                                                                                                                                                                                                   |
| <b>5(e)(ii)</b> |                                                                                                                                                                                                                                                                                   |
|                 |                                                                                                                                                                                                                                                                                   |

|                 |                |
|-----------------|----------------|
| <b>5(f)</b>     |                |
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|                 | <b>5(g)(i)</b> |
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| <b>5(g)(ii)</b> |                |
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6(a)

6(b)

6(c)

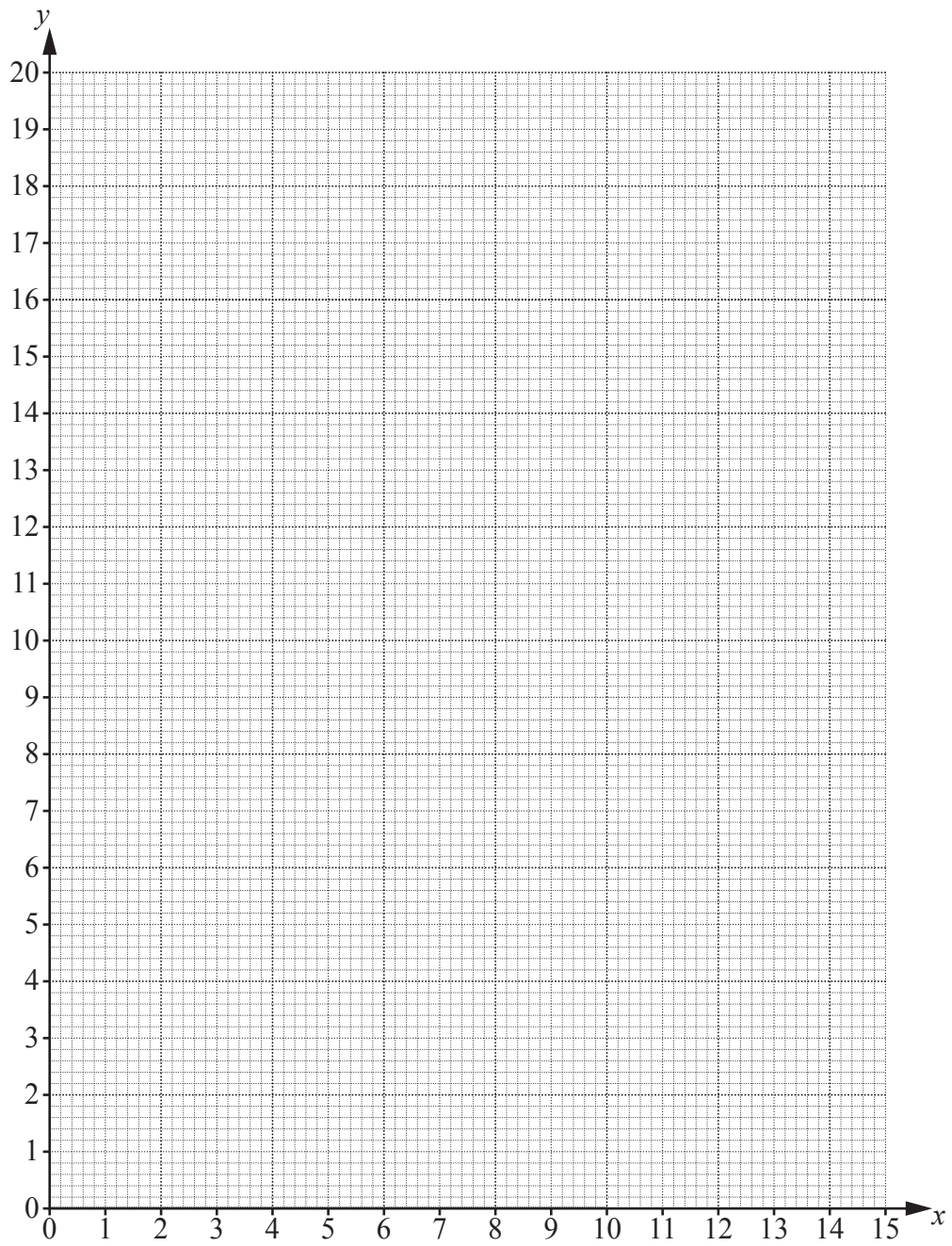
| $P$ | $x$ | $y$ | $s_1$ | $s_2$ | $s_3$ | RHS |
|-----|-----|-----|-------|-------|-------|-----|
| 1   | -26 | 0   | 0     | 9     | 0     | 90  |
| 0   | 17  | 0   | 1     | -6    | 0     | 17  |
| 0   | -2  | 1   | 0     | 1     | 0     | 10  |
| 0   | 1   | 0   | 0     | 1     | 1     | 20  |

| $P$ | $x$ | $y$ | $s_1$ | $s_2$ | $s_3$ | RHS |
|-----|-----|-----|-------|-------|-------|-----|
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|-------------|----------|
| <b>6(d)</b> |          |
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|             |          |
|             | A: B: C: |
| <b>6(e)</b> |          |
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|             |          |
|             |          |
|             | Q: X: Y: |

| 7(a)     | <table><tr><th>Activity</th><th>Immediate Predecessor(s)</th></tr><tr><td>A</td><td></td></tr><tr><td>B</td><td></td></tr><tr><td>C</td><td></td></tr><tr><td>D</td><td></td></tr><tr><td>E</td><td></td></tr><tr><td>F</td><td></td></tr><tr><td>G</td><td></td></tr></table> | Activity                 | Immediate Predecessor(s) | A |  | B |  | C |  | D |  | E |  | F |  | G |  | <table><tr><th>Activity</th><th>Immediate Predecessor(s)</th></tr><tr><td>H</td><td></td></tr><tr><td>I</td><td></td></tr><tr><td>J</td><td></td></tr><tr><td>K</td><td></td></tr><tr><td>L</td><td></td></tr><tr><td>M</td><td></td></tr><tr><td>N</td><td></td></tr></table> | Activity | Immediate Predecessor(s) | H |  | I |  | J |  | K |  | L |  | M |  | N |  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|---|--|---|--|---|--|---|--|---|--|---|--|---|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------|---|--|---|--|---|--|---|--|---|--|---|--|---|--|
|          | Activity                                                                                                                                                                                                                                                                       | Immediate Predecessor(s) |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | A                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | B                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | C                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | D                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | E                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | F                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | G                                                                                                                                                                                                                                                                              |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          | Activity                                                                                                                                                                                                                                                                       | Immediate Predecessor(s) |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| H        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| I        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| J        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| K        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| L        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| M        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| N        |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| 7(b)(i)  |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| 7(b)(ii) |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
| 7(c)     |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |
|          |                                                                                                                                                                                                                                                                                |                          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |                                                                                                                                                                                                                                                                                |          |                          |   |  |   |  |   |  |   |  |   |  |   |  |   |  |

7(d)



Duration of activity E:

H:

I:

[illegible]

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