<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>Working (Max 3)

May be seen on diagram
• Initialisation: setting Base to 0
• … and the rest of the towns to ∞
• Evidence to show values at nodes being updated
• Evidence to show ‘visited node(s)’

May be seen in working section of paper
• Evidence to show calculation of at least one route
• Evidence to show more than one route has been calculated for at least one town

Correct Answer (Max 2)
One mark for four correct values…
… One mark for all values correct

<table><tr><th>Town 1</th><th>Town 2</th><th>Town 3</th><th>Town 4</th><th>Town 5</th><th>Town 6</th></tr><tr><td>3</td><td>5</td><td>2</td><td>9</td><td>3</td><td>8</td></tr></table></td><td>5</td></tr>
</table>

Question	Answer	Marks
5(b)	**One** mark for each correct marking point **(Max 3)** • Artificial Neural Networks can be represented using graphs • Graphs provide structures for relationships // graphs provide relationships between nodes • AI problems can be defined/solved as finding a path in a graph • Graphs may be analysed/ingested by a range of algorithms • …e.g. A* / Dijksta's algorithm • …used in machine learning. • Example of method e.g. Back propagation of errors / regression methods	**3**

Question	Answer	Marks
9(a)(i)	**One** mark for correct statement **(Max 1)** • Enables deep learning to take place • Where the problem you are trying to solve has a higher level of complexity it requires more layers to solve • To enable the neural network to learn and make decisions on its own • To improve the accuracy of the result.	**1**
9(a)(ii)	**One** mark for each correct marking point **(Max 4)** • Artificial neural networks are intended to replicate the way human brains work • Weights / values are assigned for each connection between nodes • The data are input at the input layer and are passed into the system • They are analysed at each subsequent (hidden) layer where characteristics are extracted / outputs are calculated • … this process of training / learning is repeated many times to achieve optimum outputs // reinforcement learning takes place • Decisions can be made without being specifically programmed • The deep learning net will have created complex feature detectors • The output layer provides the results • Back propagation (of errors) will be used to correct any errors that have been made.	**4**

<table>
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<tr><td>9(b)</td><td>

One mark for each correct calculation as follows **(Max 4)**

- Node B (from Home) (Line 3 in table)
- Node C (from Home) (Line 4 in table)
- Node B and Node E (from A) (Lines 5 and 6 in table)
- Node F and Node School (from E) (Lines 7 and 8 in table)
- Node School (from F) (Line 9 in table)

One mark for correct path **(Max 1)**:
- Home ⇨ A ⇨ E ⇨ F ⇨ School

<table>
<tr><th></th><th>Node</th><th>Cost from Home Node (g)</th><th>Heuristic (h)</th><th>Total (f = g + h)</th></tr>
<tr><td>1</td><td>Home</td><td>0</td><td>14</td><td>14</td></tr>
<tr><td>2</td><td>A</td><td>1</td><td>10</td><td>11</td></tr>
<tr><td>3</td><td>B</td><td>5</td><td>7</td><td>12</td></tr>
<tr><td>4</td><td>C</td><td>4</td><td>9</td><td>13</td></tr>
<tr><td>5</td><td>B</td><td>1 + 3 = 4</td><td>7</td><td>11</td></tr>
<tr><td>6</td><td>E</td><td>1 + 6 = 7</td><td>3</td><td>10</td></tr>
<tr><td>7</td><td>F</td><td>7 + 1 = 8</td><td>3</td><td>11</td></tr>
<tr><td>8</td><td>School</td><td>7 + 5 = 12</td><td>0</td><td>12</td></tr>
<tr><td>9</td><td>School</td><td>8 + 3 = 11</td><td>0</td><td>11</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
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<table>
<tr><td>Final Path</td><td>Home ⇨ A ⇨ E ⇨ F ⇨ School</td></tr>
</table>

</td><td>5</td></tr>
</table>

Question	Answer	Marks
9(a)	**One** mark for each correct point (**Max 2**) • Uses artificial **neural** network(s) • … that contain(s) a high number of **hidden layers** • … modelled on the human brain. • Deep learning uses **many** layers to progressively extract higher level features from the (raw) input. • Deep learning is a **specialised** form of machine learning.	**2**
9(b)	**One** mark for each correct point (**Max 2**) • Deep learning makes good use of unstructured data. • Deep learning outperforms other methods if the data size is large. • Deep learning systems enable machines to process data with a nonlinear approach. • Deep learning is effective at identifying (hidden) patterns / patterns that humans might not be able to see / patterns that are too complex / time consuming for humans to carry out. • It can provide a more accurate outcome with higher numbers of hidden layers.	**2**