1. (a) Hill-climbing  
(b) Breadth-First search  
(c) Stochastic Hill-climbing  
(d) Random walk  
(e) Random walk

2. One possible path:

3. \[ \nabla f = ((2 - y)z + (t^3 - 1)yz, -(x - 1)z + (t^3 - 1)xz, (x - 1)(2 - y) + (t^3 - 1)xy, 2t^2xyz) \]

\[ \nabla g = \left( \begin{array}{cc} a \\ b \\ 2 + e^{ax+by+c} + e^{-(ax+by+c)} \\ 2 + e^{ax+by+c} + e^{-(ax+by+c)} \end{array} \right) \]

\[ \nabla h = (2(x - 1) \exp(x) + (x - 1)^2, 3(y - 2)^2z^3, 3(y - 2)^3z^2) \]

\[ \nabla c = (b(x - z - 2y^{-2})^{b-1}, -4by^{-3}(x - z - 2y^{-2})^{b-1}, -b(x - z - 2y^{-2})^{b-1}) \]

\[ \nabla g = (4(x - 1) - 2(y - 2), 4(y - 2) - 2(x - 1)) \]

In the following pseudocode, \( || \cdot ||_2 \) denotes the \( L_2 \) norm, also known as the Euclidean norm, ie \( ||(x_1, x_2)||_2 = \sqrt{x_1^2 + x_2^2} \)

The basic algorithm is:

Initialize \( x, y \) to small random values, and \( \epsilon \) to some small positive value.
Initialize \( \eta = .01 \)

while \( ||\nabla g||_2 > \epsilon \) do
\( (x, y) \leftarrow (x, y) - \eta \nabla g \)
end while

Substituting in the equations for the 2nd \( g(x, y) \) given in the HW:

Initialize \( x, y \) to small random values, and \( \epsilon \) to some small positive value.
Initialize \( \eta = .01 \)

while \( \sqrt{20(x - 1)^2 + 20(y - 2)^2 - 16(x - 1)(y - 2)} > \epsilon \) do
\( (x, y) \leftarrow (x, y) - \eta (4(x - 1) - 2(y - 2), 4(y - 2) - 2(x - 1)) \)
end while