Topic 16 Machines and Computational Models – Worksheet

1. Vocabulary

a.

computer	*computer*	*computer*	*computer*
A machine that takes some kind of ***input*** from its surroundings, ***processes*** the input according to given rules, and provides some kind of ***output***.			
A machine that takes some kind of ***input*** from its surroundings, ***processes***			
the input according to given rules, and provides some kind of ***output***.			

b.

embedded system	*embedded system*	*embedded system*
A device with a computer inside that is configured for a dedicated purpose.		
A device with a computer inside that is configured for a dedicated purpose.		

c.

computational model	*computational model*	*computational model*
A computational model defines the components of a system and the rules of behaviour.		
A computational model defines the components of a system and the rules		
of behaviour.		
A computational model is designed to be simulated on a computer to predict behavior.		
A computational model is designed to be simulated on a computer to		
predict behavior.		

2. Short Answer

a. What is the difference between a ***computer*** and a ***functional machine***. **(2)**

A computer is a physical device, while a functional machine is an abstract concept (1)

A functional machine does not maintain any state – the output relies solely on the input.

b. Give an example of ***negotiation*** in technological devices. **(1)**

USB-PD negotiates the voltage level that will power the device; bluetooth – link key, encryption

TCP – negotiates values to establish a connection; WiFi – data rates;

c. From algorithms you have used in this course, give an example where an algorithm can be implemented using a sub-algorithm. **(2)**

Bubble sort may use a simple swap algorithm

Merge sort may call a “merge” algorithm to merge the sorted lists

Clean the kitchen algorithm used algorithms for clearing the table, washing the dishes, etc.

d. In a simulation of the famous game theory thought experiment "The Prisoner's Dilemma", explain why each prisoner may be considered an ***agent***. **(4)**

Each prisoner acts on its own (***autonomous***) within the ***simulated*** environment.

Each prisoner ***perceives*** its environment – it knows whether it has been cheated

Each prisoner has the ***goal*** of minimizing its prison time.

e. In what ways may each individual cell in "Conway's Game of Life" be considered an *agent*? **(2)**

It perceives the environment (the adjacent cells) and reacts to them by changing its state.

Its own state affects the environment for the next round.

f. In what ways may each individual cell in "Conway's Game of Life" be considered **not** an *agent*? **(2)**

The behavior is not goal-oriented. The state of each cell is set by following a fixed,

externally-determined algorithm.

May argue each cell is not autonomous… but then prisoner algorithms are also deterministic.

g. Can an *algorithm* be a *computational model*? Explain why. (An example may be helpful.) **(3)**

FOR: A simulation of projectile motion may simply be an algorithm to calculate the motion

of the projectile.

AGAINST: Algorithms are only components; they do not define the overall system. For example

in the prisoner's dilemma, agents follow algorithms, but their interactions are defined at a higher

level. (Counter to this: the interactions also follow an algorithm!)