**ENSC 100 Quiz: November 23, 2012**

**Special Code 0001**

This is a closed-book quiz. Mark your answers on the answer sheet provided. Calculators may be used. There is exactly one right answer to each question. No marks will be deducted for wrong answers.

**Section I: In this section, you need to get at least 16 questions right to get full marks (16).**

1. On visiting a pin factory, Adam Smith observed that the most efficient way to manage the factory workers was:
	1. To plot a control chart of their output
	2. *To assign each worker a single repetitive task*
	3. To ensure that each worker was under load only 42% of the time
	4. To pay each worker according to how many pins he made
2. In `Engineering and the Environment’, the solution suggested for global warming was:
	* 1. *Immediate clear-cutting of all rain forests*
		2. Reducing our use of fossil fuels
		3. Placing giant mirrors in space
		4. Extracting carbon dioxide from the atmosphere and storing it underground
3. The large ship used to lay the first successful trans-Atlantic telegraph cables was the:
	* 1. Titanic
		2. Syrakosia
		3. *Great Eastern*
		4. Queen Elizabeth
4. Steganography is:
	* 1. That branch of palaeontology dealing with the armoured dinosaurs
		2. A method of recording speech on a punched tape
		3. *The art of hidden writing*
		4. Making a map that shows the distribution of different types of vegetation
5. Lady Ada Lovelace is best known as:
	* 1. *A writer of programs for the Analytical Engine of Charles Babbage*
		2. A tyrannical mill-owner in a novel by Charles Dickens
		3. The inventor of the steam loom
		4. The first person to isolate the radioactive element adinium
6. The Simputer is:
	* 1. Another name for a neural net
		2. The computer built at Bletchley Park to decode Enigma messages
		3. The supercomputer developed by IBM to model the folding of proteins
		4. *A computer costing about $200, designed for use in developing countries*
7. The Square of Polybius was:
	* 1. A military formation used by Roman troops
		2. A mathematical construction appearing in the First Book of Euclid
		3. *A way of translating pairs of numerals into letters*
		4. The location of the House of Wisdom in Ninth-Century Baghdad
8. Caesar’s cipher was:
	* 1. A coded message left by Julius Caesar that has never been decoded
		2. A method used to carry water over a rise, in a sealed aqueduct
		3. A way of translating pairs of numerals into letters
		4. *A simple way of encoding a message by shifting the alphabet a few letters left or right*
9. What did Einstein refer to as `the holy little geometry book’?
	* 1. *The `Elements’ of Euclid*
		2. The `Synagoge’ of Pappus
		3. The `Principia’ of Newton
		4. `The Sand-Reckoner’ of Archimedes
10. The question ``Consider the set of all sets which are not members of themselves; is this set a member of itself or not?’’ is known as:
	* 1. *Russell’s paradox*
		2. Zorn’s Lemma
		3. Frege’s Problem
		4. Boole’s dilemma
11. A Turing machine is:
	* 1. A computer capable of passing the Turing test
		2. One of the first electronic computers, built at Bletchley Park for codebreaking
		3. Any computer that uses parallel, as opposed to serial, processing
		4. *An abstract mathematical model of computation*
12. Konstantin Tsiolkovski is best remembered as:
	* 1. *the Russian father of cosmonautics*
		2. the composer of the opera Eugene Onegin
		3. the premier of the USSR from 1959 to 1968
		4. the engineer who designed the Chernobyl nuclear reactor
13. Which US President set the goal of landing an American on the Moon before 1970?
	* 1. Eisenhower
		2. *Kennedy*
		3. Johnson
		4. Nixon
14. Comparing AI research in the Seventies and Eighties with AI research in the Fifties, one of the things we notice in the later decades is:
	* 1. *Increased emphasis on the role of knowledge, as opposed to reason*
		2. A realization that intelligence has to be housed in a robotic body in order to interact effectively with the world
		3. Several of the easier AI problems, such as vision, are completely solved
		4. A concentration on solvable puzzles, like tic-tac-toe.
15. A microworld is:
	* 1. A table-top environment used to test micromachines
		2. *A simulated simple world for AI systems to reason about*
		3. A large space-station capable of sustaining life indefinitely and independently
		4. A stable ecosystem that contains a very small number of species
16. Joseph Weizenbaum’s ELIZA program was able to dupe some of its users into believing that it possessed human levels of intelligence. One factor that aided this deception was Weizenbaum’s decision to have the program simulate:
	* 1. A catatonic patient
		2. A police officer
		3. *A psychoanalyst*
		4. A person suffering from paranoid delusions
17. A neural net is:
	* 1. A computer built from living tissues
		2. A device used for torture in some South American countries
		3. Another word for a conundrum or brain-teaser
		4. *A form of parallel computer that can be taught, rather than needing to be programmed*
18. The Sanmenxia dam in China became useless a few years after it was built, due to:
	* 1. Terrorist attacks
		2. Earthquake damage
		3. *Filling up with silt*
		4. The river’s drying up as a result of climate change
19. Hormesis is:
	* 1. A process for preserving canned meat
		2. *The phenomenon of small doses of a toxin being good for the health*
		3. The gradual shrinking of the Earth’s crust as the molten centre cools
		4. The tendency of a tuned circuit to go out of tune over time
20. A *chaotic* process is typically:
	* 1. Random, but predictable
		2. Random and unpredictable
		3. *Deterministic but unpredictable*
		4. Deterministic and predictable
21. The measured length of the coastline of BC increases as we use measuring rods of progressively shorter length. This may be described by saying that:
	* 1. *The coastline has a fractal dimension greater than 1*
		2. The Lyapunov exponent of the coastline is positive
		3. The Reynolds number of the coastline exceeds a critical value
		4. The coastline’s length is represented by a transcendental number
22. Compared with a micromachine, a nanomachine:
	* 1. Is another word for the same thing
		2. Is a thousand time larger
		3. *Is a thousand time smaller*
		4. Must be made of carbon atoms rather than silicon or metal
23. If repeated application of an operation to two initially close numbers takes them increasingly far apart over time, the *Lyapunov exponent* for the iterative process:
	* 1. Must be zero
		2. Must be negative
		3. *Must be positive*
		4. Must be imaginary
24. In 2008, the continent with the lowest score on the United Nations Human Development Index (`HDI’) was :
	* 1. Asia
		2. South America
		3. *Africa*
		4. Australia

**Section II: In this section you need to get all questions right in order to get full marks (16).**

1. A very primitive form of the Chappe semaphore consists of a single wooden arm on top of a tower. This arm can take one of three positions: `Down’, `Level’, and `Up’. An observer watches the semaphore through a telescope and notes down six consecutive positions of the arm. What is the maximum possible information content of what he’s recorded?
	* 1. Between 5 and 6 bits
		2. *Between 9 and 10 bits*
		3. Between 17 and 18 bits
		4. 729 bits
2. I have two strings of random binary digits (`bits’). Each of these strings is N bits long and the information content of each string is therefore N. If I now append one of these strings to the other, the information content of the resulting string will be:
	* 1. N
		2. *2N*
		3. N2
		4. 2N
3. The following piece of pseudo-code represents a recursive algorithm. What value is returned when we run Gibo(6)?

Define Gibo(n):

If (n = 0) return (0)

Else if (n =1) return(1)

Else return (Gibo(n-1)-Gibo(n-2))

* + 1. -1
		2. *0*
		3. 1
		4. 2
1. Referring to the recursive function defined in the previous question, what is Gibo(666)?
	* 1. -1
		2. *0*
		3. 1
		4. 2
2. In Frege’s second-order logic, the symbol `∀’ represents `for all’, and the symbol `∃’ represents `There is at least one’. The symbols `∧and`∨’ represent `and’ and `or’ respectively. F is the function `lays eggs’, G is the function `can fly’, and each of the variables `x’ and `y’ can stand for any animal. Which of the following must be true?
	* 1. ∀x(Fx ∧ Gx)
		2. ∀x(Fx ∨ Gx)
		3. ∀x(Fx) and ∃y(Gy)
		4. *∃x(Fx ∧ Gx) `There is at least one animal that flies and lays eggs’*
3. In 1966, Marvin Minsky thought that the problem of getting a computer to look at a scene with a video camera and describe what it saw could be solved in about six months. This estimate was:
	* 1. Exactly right
		2. An underestimate by a factor of 10
		3. An underestimate by a factor of 20
		4. *An underestimate by a factor of at least 80*
4. Given the following three statements:

``My saucepans are the only things I have made of tin’’

``I find all your presents very useful’’

``None of my saucepans is of the slightest use’’

which one of the following statements must be true?

* + 1. *None of your presents to me was made of tin*
		2. Nothing made of tin is of any use
		3. All of my saucepans are made of tin
		4. The only useless things I have are my saucepans
1. The `travelling salesman’ problem is currently thought to be an NP problem. This means that as we increase N, the number of cities the salesman has to visit, the time required to solve the problem goes up as:
	1. N
	2. NP, for some integer P
	3. NP, for some integer P
	4. *None of the above*
2. Octal is a 8-based notation for writing numbers. In octal, the integers 0 to 7 have their conventional meanings, and the numerals `10’, `11’, `12’, etc. represent the numbers 8, 9 and 10, respectively. What is the information content of a string of eight octal digits, such as 12405711?
	* 1. 8
		2. *24*
		3. 64
		4. 88
3. A heat engine absorbs energy from a heat source at 300 K (room temperature in a warm room), turns some of it into electrical energy, and rejects the remainder to a heat sink at a temperature of approximately 0 K (a bucket of liquid helium, for example). The Carnot efficiency of such an engine will be:
	* 1. *Approximately 100%*
		2. Just over 91%
		3. Just less than 30%
		4. Such an engine is thermodynamically impossible
4. The diagram below shows the last two ply in a chess game between you and Kasparov. You currently have a choice of moves A or B. Then it is Kasparov’s turn to move, after which the game will be in one of the positions shown in the four leaf nodes at the bottom. The numbers in the leaf nodes give the value, to you, of each position. Using a minimax analysis, what is the value to you of the position in the node marked by a `?’.
	* 1. 1
		2. *10*
		3. 100
		4. 250

?

A (=10

B

1. A satellite in geostationary orbit goes around the Earth once every 24 hours. If we wanted it to go around the Earth in a longer period:
	* 1. *It would need to be in a higher orbit*
		2. It would need to be in a lower orbit
		3. It could remain at the same altitude, but we would need to increase its mass
		4. The only stable orbits around the Earth are geostationary, so no slower orbit would be possible
2. Which of the following units do Canadian engineers use for measuring power?
	* 1. Volts
		2. Joules
		3. Kilowatt-hours
		4. *Kilowatts*
3. All but one of the following units have been used to measure energy, at different periods of history and in different countries. Which is the odd one out?
	* 1. BTU’s
		2. calories
		3. Kilowatt-hours
		4. *Amperes*
4. I have designed the machine shown in the Figure below. It is a wheel with curved vanes, and massive ball bearings rest upon the vanes. The shape of the vanes causes the ball-bearings to roll to the outer edge of the wheel on the right, so that they exert a greater moment about the axis. The wheel will therefore turn clockwise, and can be used to turn a shaft from which electrical power can be generated.

(See Figure, below)



The successful operation of this device would:

* + 1. Violate the Zeroth Law of Thermodynamics
		2. *Violate the First Law of Thermodynamics*
		3. Violate the Second Law of Thermodynamics
		4. Be perfectly possible
1. An electrically powered heat pump absorbs heat from a heat source at 200 K (a cold day in the Yukon), and transfers it to a furnace at 1000 K. If the heat pump is operating at the maximum thermodynamically possible efficiency, how much electrical power must it consume in order to supply 1,250 W of heat to the furnace?
	* 1. 0.5 kW
		2. *1 kW*
		3. 1.56 kW
		4. 10 kW