Working with RAM

1. From which chapter do the following statements come from?

	STATEMENTS
2	a) RAM access time is expressed in nanoseconds;
4	b) In RAM, this set of post-office boxes is known as an array and each box is a cell.
1	c) RAM is much faster to read from and write to than the other kinds of storage in a computer.
5	d) This address is sent to the RAM controller.
4	e) A transistor acts as a gate in determining whether the value in the capacitor can be read or written.
1	f) When you turn the computer off, RAM loses its data.
3	g) RAM is organized and controlled in a way that enables data to be stored and retrieved directly to specific locations.
6	h) Access time consists of latency and *transer time*.
5	i) A capacitor with a charge over a certain voltage level represents the binary value of 1 and a capacitor with less than that charge represents a 0.
2	j) RAM is small, both in physical size (it's stored in microchip modules) and in the amount of data it can hold.
4	k) There is an *address line* for each row and each column in the set of boxes.
4	l) To add memory to your computer, you simply add more RAM modules in a prescribed configuration.
2	m) RAM comes in the form of "discrete" (meaning separate) microchip modules that plug into holes in the computer's motherboard.

2. Complete the following sentences according to the text.

a) When you turn your computer on again, your operating system and other files are once again loaded into RAM, usually from your hard disk

b) The short-term memory focuses on work at hand, but can only keep so many facts in view at one time

c) Unlike the hard disk which can become completely full of data so that it won't accept any more, RAM never runs out o memory

d) These holes connect through a bus or set of electical paths to the processor

e) Having more RAM in your computer reduces the number of times that the computer processor has to read data from your hard disk, an operation that -akes much longer than rea ing data from RAM

f) RAM is called "random access" because any storage location can be accessed directly

g) Perhaps it should have been called "nonsequential memory", because RAM access is hardly random

h) Every computer comes with a small amount of ROM that holds just enough programming so that the operating system can be loaded into RAM each time the computer is turned on

i) In general, RAM is much like an arrangement of post-office boxes in which each box can hold a 0 or a 1

j) In describing a RAM chip or module, a notation such as 256Kx16 means 256 thousand columns of cells standing 16 rows deep

k) In static RAM, instead of a capacitor-held charge, the transistor itself is a positional flip/flop switch, with one position meaning 0 and one position meaning 1.

l) For dynamic RAM, before a capacitor is read, it must be power-refreshed to ensure that the value read is valid.

m) The data that is read is transmitted along the data lines to the processor's nearby data buffer known as

level-1 cache and another copy may be held in level-2 cache or level-3 cache

n) The amount of time that RAM takes to write or to read it once the request has been received from the processor is called the access time

o) Latency is the time to coordinate signal timing and refresh after reading it

3. Fill the gaps in the text with the correct word or expression from the box.

◆ access	◆ appropriate	◆ based	◆ bit	◆ bitlines	◆ bucket	◆ capacitors
◆ circuitry	◆ computer memory	◆ counter	◆ determines	◆ directly	◆ downside	
◆ etched	◆ integrated circuit	◆ leak	◆ memory controller	◆ rating	◆ recharge	
◆ refresh operation	◆ switch	◆ wafer	◆ wordlines			

Random access memory (RAM) is a form of computer memory. RAM is considered "random access" because you can access any memory cell directly if you know the row and column that intersect at that cell.
RAM data can be accessed in any order.

Similar to a microprocessor, a memory chip is an integrated circuit (IC) made of millions of transistors and capacitor In this form of computer memory, dynamic random access memory (DRAM), a transistor and a capacitor are paired to create a memory cell, which represents a single bit of data. The capacitor holds the bit of information -- a 0 or a 1. The transistor acts as a switch that lets the control circuit on the memory chip read the capacitor or change its state.
A capacitor is like a small bucket that is able to store electrons. To store a 1 in the memory cell, the bucket is filled with electrons. To store a 0, it is emptied. The problem with the capacitor's bucket is that it has a leak. In a matter of a few milliseconds a full bucket becomes empty.

Therefore, for dynamic memory to work, either the CPU or the memory controller has to come along and ___recharge___ all of the capacitors holding a 1 before they discharge. To do this, the ___memory controller___ reads the memory and then writes it right back. This ___refresh operation___ happens automatically thousands of times per second.

This refresh operation is where dynamic RAM gets its name. Dynamic RAM has to be dynamically refreshed all of the time or it forgets what it is holding. The ___downside___ of all of this refreshing is that it takes time and slows down the memory.

Memory cells are ___etched (= geätzt, geschrieben)___ onto a silicon ___wafer___ in an array of columns (___bitlines___) and rows (___wordlines___). The intersection of a bitline and wordline constitutes the address of the memory cell.

DRAM works by sending a charge through the ___appropriate___ column (CAS) to activate the transistor at each bit in the column. When writing, the row lines contain the state the capacitor should take on. When reading, the sense-amplifier ___determines___ the level of charge in the capacitor. If it is more than 50 percent, it reads it as a 1; otherwise it reads it as a 0. The ___counter___ tracks the refresh sequence ___based___ on which rows have been accessed in what order. The length of time necessary to do all this is so short that it is expressed in nanoseconds (billionths of a second). A memory chip ___rating___ of 70ns means that it takes 70 nanoseconds to completely read and recharge each cell.