Brookshear-*Computer Science: An Overview*, 9th edition

Test Bank—Chapter Two (Data Manipulation)

The following table is from Appendix C of the text. It is included here so that it can be incorporated in tests for student reference. Questions in this test bank refer to this table as the "language description table."

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY. *Example:* 14A3 would cause the contents of the memory cell located at address A3 to be placed in register 4.
2	RXY	LOAD the register R with the bit pattern XY. *Example:* 20A3 would cause the value A3 to be placed in register 0.
3	RXY	STORE the bit pattern found in register R in the memory cell whose address is XY. *Example:* 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1.
4	0RS	MOVE the bit pattern found in register R to register S. *Example:* 40A4 would cause the contents of register A to be copied into register 4.
5	RST	ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R. *Example:* 5726 would cause the binary values in registers 2 and 6 to be added and the sum placed in register 7.
6	RST	ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R. *Example:* 634E would cause the values in registers 4 and E to be added as floating-point values and the result to be placed in register 3.
7	RST	OR the bit patterns in registers S and T and place the result in register R. *Example:* 7CB4 would cause the result of ORing the contents of registers B and 4 to be placed in register C.
8	RST	AND the bit patterns in register S and T and place the result in register R. *Example:* 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0.
9	RST	EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R. *Example:* 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5.
A	R0X	ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end. *Example:* A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion.
B	RXY	JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.) *Example:* B43C would first compare the contents of register 4 with the contents of register 0. If the two were equal, the pattern 3C would be placed in the program counter so that the next instruction executed would be the one located at that memory address. Otherwise, nothing would be done and program execution would continue in its normal sequence.
C	000	HALT execution. *Example:* C000 would cause program execution to stop.

Multiple Choice Questions

1. Which of the following is not contained in a CPU?

A. Instruction register B. Program counter
C. General-purpose register D. Memory cell

ANSWER: D

2. Which of the following instructions (as described in the language description table) changes the contents of a memory cell?

A. 10AB B. 20AB C. 30AB D. 40AB

ANSWER: C

3. Which of the following instructions (as described in the language description table) places 00000000 in register A?

A. 1A00 B. 2A00 C. 3A00 D. 200A

ANSWER: B

4. Which of the following instructions (as described in the language description table) places 00000000 in register 5?

A. 25FFB. 9555 C. 15FFD. 8555

ANSWER: B

5. Which of the following instructions (as described in the language description table) will not change the contents of register 5?

A. 1508 B. 2508 C. A503 D. A508

ANSWER: D

6. Which of the following instructions (as described in the language description table) is equivalent to requesting that register A be rotated to the left by three bits?

A. AA05 B. AA03 C. AA08 D. AA01

ANSWER: A

7. Which of the following instructions (as described in the language description table) changes the contents of register 7?

A. 4077 B. 4075 C. 4057 D. 37BB

ANSWER: C

8. Which of the following is not a form of parallel processing?

A. SISD B. MIMD C. SIMD

ANSWER: A

9. In which of the following locations is information most readily available for manipulation by the CPU?

A. General-purpose registers B. Main memoryC. Mass storage

ANSWER: A

10. The bus in a computer is an example of which form of communication?

A. Serial B. Parallel C. Neither A nor B

ANSWER: B

11. Which of the following instructions does not fall in the category of arithmetic/logic instructions?

A. ROTATE B. ADD C. OR D. JUMP

ANSWER: D

12. Which of the following instructions falls in the category of data transfer instructions?

A. LOAD B. AND C. ROTATE D. JUMP

ANSWER: A

13. Which of the following is not a component of a machine instruction?

A. Op-code B. Port C. Operand

ANSWER: B

14. Which of the following is not an activity performed entirely within a CPU?

A. Fetch instructions B. Perform Boolean operations
C. Perform arithmetic operations D. Move data between registers

ANSWER: A

15. What mask in register F would cause the instruction 8AAF (refer to the language description table) to put a 0 in the most significant bit of register A without disturbing the other bits?

A. 11111110 B. 00000001 C. 10000000 D. 011111111

ANSWER: D

16. What mask in register F would cause the instruction 7AAF (refer to the language description table) to put a 1 in the most significant bit of register A without disturbing the other bits?

A. 11111110 B. 00000001 C. 10000000 D. 011111111

ANSWER: C

17. Which of the following instructions will not produce the same result as the other two? (Refer to the language description table.)

A. A502 B. A506 C. A50A

ANSWER: B

18. Which of the following instructions will not produce the same result as the other two? (Refer to the language description table.)

A. 9555 B. 2500 C. 1500

ANSWER: C

19. If register A contained the pattern 00000000, which of the following instructions could alter the contents of register 0? (Refer to the language description table.)

A. 700A B. 800A C. 900A

ANSWER: B

20. Which of the following instructions (as described in the language description table) is essentially an unconditional jump?

A. B033 B. B133C. B233D. B333

ANSWER: A

Fill-in-the-blank/Short-answer Questions

1. If register 0 contains the pattern 01101001 before executing the instruction A003 (see the language description table), what bit pattern will be in register 0 after the instruction is executed?

_____

ANSWER: 00101101

2. If registers 5 and 6 contain the bit patterns 5A and 58 respectively, what bit pattern will be in register 4 after executing the instruction 5456? (See language description table.)

_____

ANSWER: B2

3. If registers 5 and 6 contain the bit patterns 5A and 58 respectively, what bit pattern will be in register 4 after executing the instruction 6456? (See language description table and assume a floating-point format in which the most significant bit is the sign bit, the next three bits represent the exponent field in excess notation, and the last four bits represent the mantissa.)

_____

ANSWER: 69

4. Write the answer to each of the following logic problems.

```
    10101010          10101010          10101010
AND 11110000      OR  11110000      XOR 11110000
```

ANSWER: 10100000, 11111010, and 01011010

5. Suppose registers E and F contained AA and CC, respectively. What bit pattern would be in register D after executing each of the following instructions (see language description table)?

A. 7DEF _____

B. 8DEF _____

C. 9DEF _____

ANSWER: A. EE B. 88 C. 66

6. If registers 0, 1, and 2 contain the patterns A5, A5, and B7, respectively, which of the following instructions will result in a jump to location AA? (Refer to the language description table.)

A. B0AA B. B1AA C. B2AA

_____

ANSWER: A and B

7. If registers 0 and 1 contain the patterns B5 and F0, respectively, what will be in register 1 after executing each of the following instructions? (Refer to the language description table.)

A. A102 _____

B. 4001 _____

C. 4010 _____

ANSWER: A. 3C B. B5 C. F0

8. Suppose the instruction B1A5 (as described in the language description table) is stored in main memory at addresses E0 and E1. Moreover, suppose registers 0 and 1 both contain the pattern FF. What value will be in the CPU's program counter immediately after executing the instruction?

_____

ANSWER: A5

9. Suppose the instruction B1A5 (as described in the language description table) is stored in main memory at addresses E0 and E1. Moreover, suppose registers 0 and 1 contain the patterns FF and 75, respectively. What value will be in the CPU's program counter immediately after executing the instruction?

_____

ANSWER: E2

10. Encode each of the following commands in terms of the machine language described in the language description table.

A. _____ LOAD register 7 with the value A5.

B. _____ LOAD register 7 with the contents of the memory cell at address A5.

C. _____ ADD the contents of registers 5 and 6 as thought they were values in two's complement notation and leave the result in register 4.

D. _____ OR the contents of registers 5 and 6, leaving the result in register 4.

ANSWER: A. 27A5 B. 17A5 C. 5456 (or 5465) D. 7456 (or 7465)

11. Encode each of the following commands in terms of the machine language described in the language description table.

A. _____ ROTATE the contents of register 7 to the right 5 bit positions.

B. _____ JUMP to the instruction at address B2 if the content of register 2 equals that of register 0.

C. _____ ADD the contents of registers 5 and 6 as thought they were values in floating-point notation and leave the result in register 4.

D. _____ AND the contents of registers 5 and 6, leaving the result in register 4.

ANSWER: A. A705 B. B2B2 C. 6456 (or 6465) D. 8456 (or 8465)

12. Decode each of the following instructions that were encoded using the language description table.

A. 4034 _____

B. 8023 _____

C. B288_____

D. 2345 _____

ANSWER: A. MOVE the contents of register 3 to register 4.
B. AND the contents of registers 2 and 3, leaving the result in register 0.
C. JUMP to the instruction at address 88 if the contents of register 2 equals that of register 0.
D. LOAD register 3 with the pattern 45.

13. Decode each of the following instructions that were encoded using the language description table.

A. A004 _____

B. 1234 _____

C. 5678 _____

D. C000 _____

ANSWER: A. ROTATE the contents of register 0 to the right by four bit positions.
B. LOAD register 2 with the bit pattern from the memory cell at address 34.
C. ADD the contents of registers 7 and 8 as though they represented values encoded in two's complement notation and leave the result in register 6.
D. HALT.

14. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address content

00	21
01	0B
02	14
03	04
04	C0
05	00

A. What bit pattern will be in register 4 when the machine halts?

_____

B. What bit pattern will be in register 1 when the machine halts?

_____

ANSWER: A. C0 B. 0B

15. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content
00	10	07	00
01	02	08	C0
02	24	09	00
03	04	0A	C0
04	B4	0B	00
05	0A	0C	C0
06	C0	0D	00

A. What bit pattern will be in register 0 when the machine halts?

_____

B. What bit pattern will be in register 4 when the machine halts?

_____

C. What bit pattern will be in the program counter when the machine halts?

_____

ANSWER: A. 24 B. 04 C. 08

16. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content
00	25	07	00
01	03	08	C0
02	20	09	00
03	F9	0A	C0
04	53	0B	00
05	05	0C	C0

06	33	0D	00

A. What bit pattern will be in register 5 when the machine halts?

_____

B. What bit pattern will be in register 0 when the machine halts?

_____

C. What bit pattern will be in register 3 when the machine halts?

_____

D. What bit pattern will be at memory location 00 when the machine halts?

_____

ANSWER: A. 03 B. F9 C. FC D. FC

17. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content
00	25	07	00
01	03	08	34
02	A5	09	04
03	02	0A	B0
04	35	0B	03
05	03	0C	C0
06	24	0D	00

A. What bit pattern will be in register 5 when the machine halts?

_____

B. What bit pattern will be in the program counter when the machine halts?

_____

C. What bit pattern will be at memory location 04 when the machine halts?

_____

ANSWER: A. C0 B. 05 C. 00

18. Below is a short routine written in the machine language described in the language description table and stored in a machine's memory beginning at address 50. What must be in the memory cell at address 40 to avoid an unending loop?

Address	Instruction
50	2001
52	1340
54	8330
56	B352

58 ...

_____

ANSWER: Any bit pattern whose least significant bit is 0

19. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content
00	B0	07	C0
01	03	08	00
02	25	09	23
03	B0	0A	B0
04	0C	0B	03
05	C0	0C	B0
06	00	0D	07

A. How many instructions will be executed before the machine halts?

_____

B. What bit pattern will be in the program counter when the machine halts?

_____

ANSWER: A. 4 B. 09

20. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 00.

address	content	address	content
00	20	07	12
01	02	08	B2
02	21	09	0C
03	01	0A	B0
04	22	0B	06
05	01	0C	C0
06	52	0D	00

A. What bit pattern will be in register 2 when the machine halts?

_____

B. How many times will the instruction at address 06 be executed before the machine halts?

_____

ANSWER: A. 02 B. 2

Vocabulary (Matching) Questions

The following is a list of terms from the chapter along with descriptive phrases that can be used to produce questions (depending on the topics covered in your course) in which the students are ask to match phrases and terms. An example would be a question of the form, "In the blank next to each phrase, write the term from the following list that is best described by the phrase."

Term	Descriptive Phrase
op-code	The part of a machine instruction that identifies the basic operation to be performed
machine language	A means of encoding instructions
machine cycle	The process of fetching and executing instructions that is repeated over and over by the CPU
register	A location within a CPU for temporary data storage
masking	A means of isolating particular bits within a bit pattern
bus	The communication path between a CPU and main memory
memory-mapped I/O	The technique of communicating with peripheral devices as though they were memory cells
pipeling	A means of processing more than one instruction at a time
stored-program concept	A technique of recording programs in main memory from where they can be accessed and executed
program counter	Used by the CPU to keep its place in the program being executed main memory from where they can be retrieved and executed
controller	The interface between "a computer" and a peripheral device
modem	Modulator-demodulator
port	The "connection" through which a CPU communicates with a peripheral device
USB	A communication system by which a variety of peripheral devices can be connected to a computer
clock	Used to synchronize the operations within a computer
status word	A means by which a peripheral device reports its condition
bps	A means of measuring the rate of data transfer
CISC	A computer whose machine language contains many complex instructions
handshaking	Refers to the two-way communication that takes place between a computer an a peripheral device
bandwidth	Refers to a communication path's maximum capacity for transferring data
DMA	The ability of a peripheral device to communicate directly with a computer's main memory

General Format Questions

1. Describe the machine cycle.

ANSWER: Fetch an instruction and increment the program counter, decode the instruction, and execute the instruction.

2. Explain the concept of throughput and techniques by which throughput is increased.

ANSWER: Throughput measures the amount of "work" performed by a computer rather than the speed with which the computer executes instructions. Throughput is increased by introducing parallel processing techniques such as pipeling or parallel processing via multiprocessor designs.

3. What is the difference between a conditional jump instruction and an unconditional jump instruction?

ANSWER: A conditional jump instruction will result in a “jump” to another location only under certain conditions whereas an unconditional jump instruction will result in a “jump” to another location under all conditions.

4. The following is a routine encoded in the machine language described in the language description table. Explain (in a single sentence) what the routine does. (Explain what the entire routine does as a unit rather than reciting what each instruction does.)

```
12A0
32B0
12A1
32B1
12A2
32B2
```

ANSWER: It copies the contents of memory cells A0 through A2 to memory cells B0 through B2.

5. The following is a routine encoded in the machine language described in the language description table. Explain (in a single sentence) what the routine does. (Explain what the entire routine does as a unit rather than reciting what each instruction does.)

```
210F
12A0
8212
32A0
```

ANSWER: It places 0s in the four most significant bits of memory cell A0 without disturbing the other four bits.

6. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. What will happen if the machine is started with its program counter containing 00?

address	content
00	21
01	B0
02	31
03	04
04	C0
05	00

ANSWER: The machine will change the last instruction to a jump instruction and continue to repeat the same routine over and over.

7. Using the machine language described in the language description table, write a sequence of instructions that will place the pattern FF in the memory cell at address A0.

ANSWER: 2XFF, 3XA0 (where X can be any register but must be the same in both instructions)

8. Using the machine language described in the language description table, write a sequence of instructions that will place a 1 in the most significant bit of the memory cell at address A0 without disturbing the other bits.

ANSWER: 2X80, 1YA0, 7YXY, 3YA0 (where X and Y can be any distinct registers)

9. Using the machine language described in the language description table, write a sequence of instructions that will add five to the value (represented in two's complement notation) stored at memory address A0.

ANSWER: 2X05, 1YA0, 5YXY, 3YA0 (where X and Y can be any distinct registers)

10. Using the machine language described in the language description table, write a sequence of instructions that will subtract one from the value (represented in two's complement notation) stored at memory address A0.

ANSWER: 2XFF, 1YA0, 5YXY, 3YA0 (where X and Y can be any distinct registers)

11. Using the machine language described in the language description table, write a sequence of instructions that will shift the contents of the memory cell at address A0 three bit positions to the right while filling the holes at the left end with 0s.

ANSWER: 1XA0, AX03, 2Y1F, 8XXY, 3XA0 (where X and Y can be any distinct registers)