BMB101 Fall 2017 Midterm Exam I
Duration: **105 minutes**

Student ID: |___|___|___|___|___|___|___|___|___|___|___|

First Name(s): _____ **Last Name:** _____ **Section:** _____

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*Do **not** turn this page until you are told to do so.*
In the meantime, please read the instructions below.

Good Luck!

This exam contains **10 multi-part questions** and you have **105 minutes** to earn 100 marks.

- When the exam begins, please write your student ID, name and lecture section on top of this page, and sign the academic integrity code given below.
- Check that the exam booklet contains **6 pages** to the exam, including this one.
- This exam is a **closed book and notes exam**.
- Show all work, as partial credit will be given since you will be graded not only on the correctness and efficiency of your answers, but also on your clarity that you express it. Be neat.

# 1:	_____/ 6
# 2:	_____/ 9
# 3:	_____/ 18
# 4:	_____/ 12
# 5:	_____/ 6
# 6:	_____/ 6
# 7:	_____/ 12
# 8:	_____/ 10
# 9:	_____/ 8
# 10:	_____/ 13
TOTAL:	_____/ 100

It is a violation of the Academic Integrity Code to look at any exam paper other than your own, any other reference material (books, lecture notes), or to give inappropriate help to someone or to receive unauthorized aid by someone. Please also not discuss this exam with the students who are scheduled to take a makeup exam.

Academic Integrity is expected of all students of Hacettepe University at all times, whether in the presence or absence of members of the faculty. Do NOT sign nor take this exam if you do not agree with the honor code.

Understanding this, I declare I shall not give, use or receive unauthorized aid in this examination.

Signature: _____

Question 1. [6 MARKS]
Match each item with the related ones from the list below. Write the correct item on the blank line with each definition. Items are used only once, and not all items have a related item provided.

Terms

~~*imperative knowledge*~~	IBM	Enigma cipher
declarative knowledge	assembler	main memory
stored program computer	first programmer	flowchart
polynomial function	Emoji	control flow

Ex. algorithm *imperative knowledge*

(b) Analytical Engine _____

(c) Unicode _____

(d) Difference Engine _____

(e) Program Counter _____

(f) Ada Lovelace _____

(g) Alan Turing _____

Question 2. [9 MARKS]
Binary Representations and Boolean Algebra.

(a) [2 MARKS] A Gigabyte (GB) is 2^{30} Bytes and a Kilobyte (KB) is 2^{10} Bytes. If you have a storage device with a capacity of 16 GB, how many 32KB files can you fit in that device? Express the result as a power of 2, without converting it to decimal?

(b) [2 MARKS] Compute the decimal value of the byte 10101010 if it is interpreted as an unsigned integer.

(c) [2 MARKS] Compute the decimal value of the byte 10101010 if it is interpreted as a signed 2's complement integer.

(d) [3 MARKS] Let $S = a\bar{b} + \bar{a}b$, where a and b are Boolean variables. Fill in the truth table below to compute S.

a	b	$a\bar{b}$	$\bar{a}b$	S
0	0			
0	1			
1	0			
1	1			

Question 3. [18 MARKS]

(a) [14 MARKS] Please complete the trace table (line by line execution of the code) of the given HMMM code. If there is an update on registers or something to print on screen, fill the cell of the related line. Otherwise, only write down the line number of the current instruction. Assume that the user enters the input 3 on line 0 (`0 read r1`).

Instruction documentation:

`halt`	Stop!
`read rX`	Place user input in register `rX`
`write rX`	Print contents of register `rX` to screen.
`setn rX N`	Set register `rX` equal to the integer `N` (-128 to +127)
`addn rX N`	Add integer `N` (-128 to 127) to register `rX`
`mod rX rY rZ`	Set `rX = rY % rZ` (returns the remainder of integer division)
`mul rX rY rZ`	Set `rX = rY * rZ`
`jumpn N`	Set program counter to address `N`
`jumpr rX`	Set program counter to address in `rX`
`jeqzn rX N`	If `rX == 0`, then jump to line `N`
`calln rX N`	Copy the next address into `rX` and then jump to mem. addr. `N`

HMMM Code

```
0  read  r1
1  setn  r2 2
2  jeqzn r1 8
3  mod   r3 r1 r2
4  jeqzn r3 6
5  calln r4 9
6  addn  r1 -1
7  jumpn 2
8  halt
9  mul   r3 r1 r1
10 write r3
11 jumpr r4
```

Trace Table

#Line	r1	r2	r3	r4	Screen Out
0	3				
1		2			
2					
3			1		

(b) [4 MARKS] What is the purpose of this code? Describe it with one simple sentence.

Question 4. [12 MARKS]
For each code fragment in the table below, write down the printed output when the code fragment is executed. Write `ERROR` and give a brief explanation of why an error occurs if you think the code would cause an error.

Code	**Output or Cause of Error**
`for i in range(-1, 6, 3):` `  print(i)`	
`print(25//2+4.5)`	
`print(True and ('1' + 1) == 2)`	
`print(64 / 4 ** 2 - 2)`	
`print("11" + str(3))`	

`x=5`
`if x > 2:`
`  print('in the middle')`
`elif x > 4:`
`  print('higher')`
`else:`
`  print('lower')`	

Question 5. [6 MARKS]
Consider the following Python function.

```
def my_func(m,n):
    i=0
    result = 0
    while i <= (n-1):
        i=i+1
        result = result + i ** m
    return result
```

What would the value of the variable `x` be after executing the following assignment statement below?

```
x = my_func(2,4)
```

Question 6. [6 MARKS]
Write down what Python would print. If an error occurs, just write `ERROR`, and briefly describe the error.

```
>>> name = 'rick'
>>> def my_func():
       name = 'morty'

>>> my_func()
>>> name
```

Question 7. [12 MARKS]
Consider the following Python function where `n` is assumed to be a positive integer:

```
def compute(n, m):
    p=1
    e = m
    while e > 0:
        p=p*n
        e=e-1
    return p
```

(a) [6 MARKS] Trace this function for `n = 4`, `m = 3`, showing the value of `e` and `p` in the table above at the end of each iteration of the loop. The initial values of `p` and `e` are given for you in the table. Use as many spaces as you need.

p	e
1	3

(b) [2 MARKS] Which of the following functions is being computed by `compute` above? Circle your answer.

A. nm B. n+m C. n^m D. m^n E. None of these

(c) [4 MARKS] Suppose that the `return` statement was indented as below. What will `compute(4,3)` return this time?

```
def compute (n, m):
    p=1
    e = m
    while e > 0:
        p=p*n
        e=e-1
        return p
```

Question 8. [10 MARKS]

Suppose we have defined a Python function named `randint(n,m)` which returns a random integer between `n` and `m`, inclusive (`n` and `m` are included). For example, a function call as `randint(1,3)` returns a random integer which is either 1 or 2 or 3.

Using the `randint` function, show how to compute the following using one Python expression:

(a) A random **even** integer between 10 and 20, including 10 and 20. _____

(b) A random **odd** integer between 5 and 15, including 5 and 15. _____

Question 9. [8 MARKS]
Please complete the missing parts of the code to provide the given output.

Code:

```
for ____ in range(________):
    if i % 2 == 0:
        print(i,end="")
        for j in __________:
            print(" *",end="")
        print()
    else:
        print(_______)
```

Output:

```
10 * *
9 *
8 * *
7 *
6 * *
5 *
4 * *
3 *
2 * *
1 *
```

Question 10. [13 MARKS]
For the following expressions, write down what Python would print. If an error occurs, just write `ERROR`, and briefly describe the error.

```
def r2d2(bb8, c3po):
   return bb8+c3po

def luke(c3po, bb8):
   return bb8 / c3po

anakin, obiwan, quigon = 1, 3, 17

def jedi(obiwan, quigon, anakin):
   print(r2d2(obiwan, luke(quigon, anakin)))
   return luke(anakin, bb8)
```

```
>>> print(r2d2(anakin, luke(anakin, anakin)))
```

```
>>> print(print(obiwan - quigon), quigon)
```

```
>>> jedi(1, 1, 2)
```

```
>>> jedi(obiwan, 2, anakin)
```