

MANISA CELAL BAYAR UNIVERSITY – DEPARTMENT OF COMPUTER ENGINEERING
PROBLEM SET FOR PARALLEL PROGRAMMING

WEEK 02: DATA STRUCTURES IN PYTHON

1. What is the correct writing of the programming language that we used in this course?

- ☐ () Phytton
- ☐ () Pyhton
- ☐ () Pthyon
- ☐ () Python

2. What is the output of the code below?
`my_name = "Bora Canbula"`

```
print(my_name[2::-1])
```

- ☐ () alu
- ☐ () ula
- ☐ () roB
- ☐ () Bor

3. Which one is not a valid variable name?

- ☐ () for_
- ☐ () Manisa_Celal_Bayar_University
- ☐ () IF
- ☐ () not

4. What is the output of the code below?

```
for i in range(1, 5):  
    print(f"{i:2d} {(i/2):4.2f}", end='')
```

- ☐ () 010.50021.00031.50042.00
- ☐ () 10.50 21.00 31.50 42.00
- ☐ () 1 0.5 2 1.0 3 1.5 4 2.0
- ☐ () 100.5 201.0 301.5 402.0

5. Which one is the correct way to print Bora's age?

```
profs = [  
    {"name": "Yener", "age": 25},  
    {"name": "Bora", "age": 37},  
    {"name": "Ali", "age": 42}  
]
```

- ☐ () profs["Bora"]["age"]
- ☐ () profs[1][1]
- ☐ () profs[1]["age"]
- ☐ () profs.age[name="Bora"]

6. What is the output of the code below?

```
x = set([int(i/2) for i in range(8)])  
print(x)
```

- ☐ () {0, 1, 2, 3, 4, 5, 6, 7}
- ☐ () {0, 1, 2, 3}
- ☐ () {0, 0, 1, 1, 2, 2, 3, 3}
- ☐ () {0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4}

7. What is the output of the code below?

```
x = set(i for i in range(0, 4, 2))  
y = set(i for i in range(1, 5, 2))  
print(x^y)
```

- ☐ () {0, 1, 2, 3}
- ☐ () {}
- ☐ () {0, 8}
- ☐ () SyntaxError: invalid syntax

8. Which of the following sequences is immutable?

- ☐ () List
- ☐ () Set
- ☐ () Dictionary
- ☐ () String

9. What is the output of the code below?

```
print(int(2_999_999.999))
```

- ☐ () 2
- ☐ () 3000000
- ☐ () ValueError: invalid literal
- ☐ () 2999999

10. What is the output of the code below?

```
x = (1, 5, 1)  
print(x, type(x))
```

- ☐ () [1, 2, 3, 4] <class 'list'>
- ☐ () (1, 5, 1) <class 'range'>
- ☐ () (1, 5, 1) <class 'tuple'>
- ☐ () (1, 2, 3, 4) <class 'set'>

WEEK 03: FUNCTIONS AND DECORATORS

1. Does a Python function always return a value?

- ☐ True
- ☐ False

2. Which of the following is the valid start to define a function in Python?

- ☐ `define func():`
- ☐ `function func() {`
- ☐ `void func():`
- ☐ `def func():`

3. What does return from call `mltpl(2,3)`?

```
def mltpl(a, b=1):  
    return a*b
```

Your Answer:

4. How can you use the following function to print exactly 'ParallelProgramming'?

```
def a(x):  
    def b(y):  
        print(y, end='')  
    print(x, end='')
```

- ☐ `a('Parallel Programming')`
- ☐ `a('Parallel');b('Programming')`
- ☐ `a('Parallel');a('Programming')`
- ☐ `a.b('ParallelProgramming')`

5. How can you change 'BC' with your own initials in the following function?

```
def speak(s):  
    if not speak.who:  
        speak.who = 'BC'  
    print(f"{speak.who} says {s}")
```

Your Answer:

6. There is a module called 'logging' to employ logging facility in Python.

```
import logging  
logging.info('Just a normal message')  
logging.warning('Not fatal but still noted')  
logging.error('There is something wrong')
```

You are expected to implement logging feature to an existing code which uses the function below.

```
def my_ugly_debug(s, level=0):  
    pre_text = [  
        "INFO",  
        "WARNING",  
        "ERROR"  
    ]  
    print(f"{pre_text[level]}: {s}")
```

You are not allowed to make changes in `my_ugly_debug`, so find another way.

WEEK 04: TESTS, LOGGING, AND COROUTINES

1. Write the `sum_of_digits` function which satisfies the tests given below.

```
def sum_of_digits(n: int) -> int:
    pass

if __name__ == "__main__":
    # tests for integer values
    tests = [[1, 1], [23, 5], [1001, 2], [5623, 16]]
    for x in tests:
        if not sum_of_digits(x[0]) == x[1]:
            str = f"Value test is failed for {x[0]}"
            exit(str)
    # tests for non-integer values
    tests = [1.5, 1 + 2j, "a", True]
    for x in tests:
        if not sum_of_digits(x) == TypeError:
            str = f"Type test is failed for {x}"
            exit(str)
    print("Tests are completed.")
```

2. Rewrite the test part of the code given in question 1 by using logging module.

3. The url www.canbula.com/prime/{n} returns a dictionary including the prime numbers below an integer n.

Example:

Request: <https://www.canbula.com/prime/5>

Response: {"n": "5", "primes": [2, 3]}

We want to test this service but the problem is response times are really long. Therefore you are requested to:

- Write tests for almost all scenarios
- Your tests should be running asynchronously so we don't have to wait for every test sequentially
- If you still have some extra time, develop your own project with Flask or FastAPI, which satisfies your tests.

WEEK 05: SCHEDULING WITH ASYNCIO

1. How can you classify a problem as CPU-bound or IO-bound?

2. When do we use context managers?

3. Code given below raises RuntimeWarning, correct the code to call the coroutine without an error.


```
import asyncio

async def an_async_func(delay: int) -> None:
    await asyncio.sleep(delay)
    print(f"U called me with "
          f"{delay} seconds delay.")
    return None

an_async_func(3)
```

4. We have coroutines A, B, C, D, E, F, G on a time scale given as:

| | | | |
|---|---|---|---|
| A | B | C | D |
| E | | F | |
| G | | | |

Time 

Please write a main() coroutine which schedules the coroutines given as in the time scale.

WEEK 06: THREADS

1. Create two threads by using a target function and using a sub-class of Thread class from threading module. Emphasize the difference.

4. Create a daemon thread which is continuously checking if a local file is changed by another program.

2. What is the difference between a non-daemon thread and a daemon thread?

3. Write a class which creates a thread from a coroutine.

WEEK 07: GLOBAL INTERPRETER LOCK, RACE CONDITION, DEADLOCK

1. If Python is single-threaded, why do we create multiple threads and how does Python make us feel like it is running them simultaneously?

3. Which problem do we solve by using the just-in-time compiler from Numba?

2. Save my money from a possible race condition in the following code.

```
import threading

class Wallet:
    def __init__(self, money:int = 0):
        self.money = money

    def spend(self, amount):
        self.money -= amount

    def save(self, amount):
        self.money += amount

if __name__ == "__main__":
    wallet = Wallet()
    savers = [
        threading.Thread(
            target=wallet.save, args=(10,)
        )
        for _ in range(100000)
    ]
    spenders = [
        threading.Thread(
            target=wallet.spend, args=(10,)
        )
        for _ in range(100000)
    ]
    for saver, spender in zip(savers, spenders):
        saver.start()
        spender.start()
    for saver, spender in zip(savers, spenders):
        saver.join()
        spender.join()
    print(f"The total money in wallet: {wallet.money}")
```

4. Prevent these threads to be stuck by implementing a timeout feature.

```
import threading

class Resources(threading.Thread):
    def __init__(self, lock1, lock2):
        super().__init__()
        self.lock1 = lock1
        self.lock2 = lock2

    def run(self):
        with self.lock1:
            print(f"Thread {self.name} acquired lock1")
        with self.lock2:
            print(f"Thread {self.name} acquired lock2")

if __name__ == "__main__":
    lock1 = threading.Lock()
    lock2 = threading.Lock()
    t1 = Resources(lock1, lock2)
    t2 = Resources(lock2, lock1)
    t1.start()
    t2.start()
    t1.join()
    t2.join()
```

WEEK 08: REVIEW BEFORE MIDTERM EXAM

1. Write a decorator which creates desired number of threads from a function.

2. Suppose that the solution of Question 1 is given, improve this decorator to not suffering from GIL.

3. The code given below is missing the definition of LimitThreads class. Define this class as a daemon thread which is going to limit the number of active threads that can be created from main() function.

```
import threading
import time
import random

class Thread2Create(threading.Thread):
    def __init__(self):
        super().__init__()
        self.go = True

    def run(self):
        n = random.randint(5, 10)
        for i in range(n):
            if not self.go:
                print(f"Thread {self.name} stopped")
                return
            print(f"Thread {self.name} will live for {n-i}/{n} seconds")
            time.sleep(1)

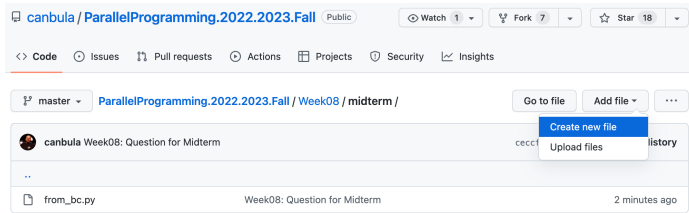
    def join(self, timeout=None):
        self.go = False

def main():
    thread_limiter = LimitThreads(5)
    thread_limiter.start()
    while True:
        time.sleep(1)
        Thread2Create().start()

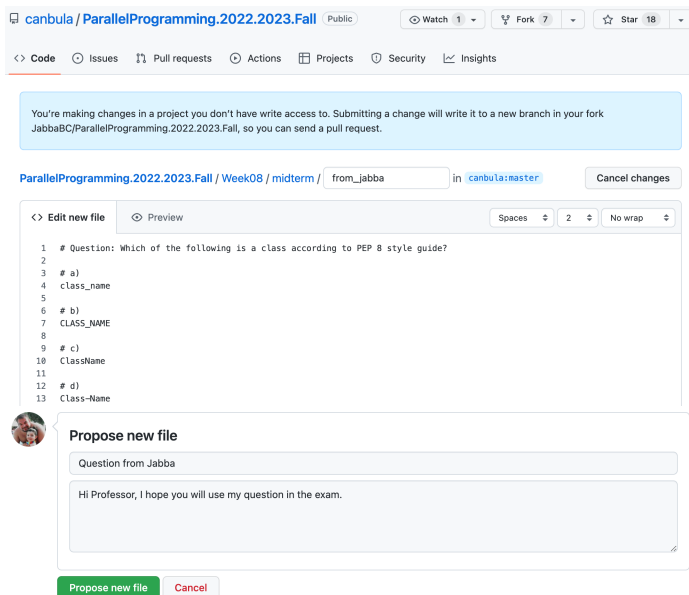
if __name__ == '__main__':
    main()
```

DO YOU WANT TO CONTRIBUTE TO THE QUESTIONS OF MIDTERM EXAM?

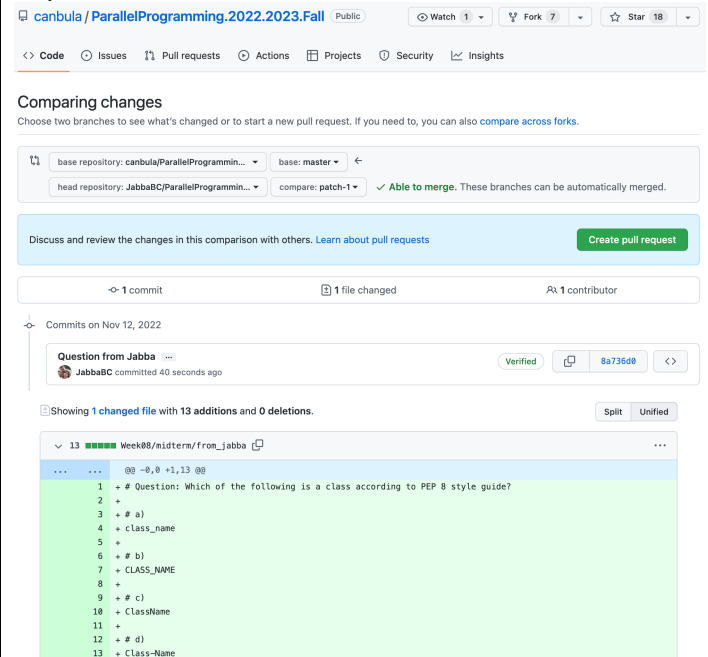
In GitHub repo of this course, you will find a folder as Week08/midterm. Go to this folder and select **Add file > Create new file**.



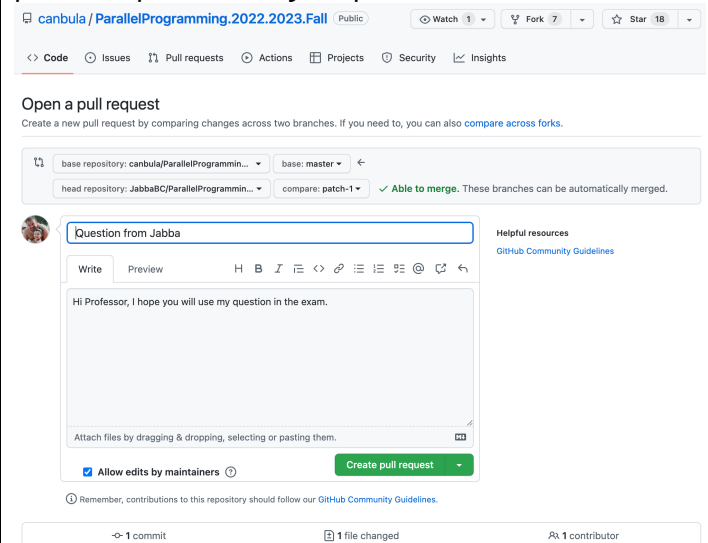
Write your question and the solution as a text file or a .py file. Then fill the form below and click **Propose new file** button.



Review your question and click **Create pull request** button to submit your file to my repo.



Click **Create pull request** button to open a pull request on my repo.



After I review your pull request you become a contributor of this repo. Also you can follow the changes in this folder to be aware of the question that your friends sent.

