

i Forside

UNIVERSITY OF OSLO
Faculty of Mathematics and Natural Sciences

Mid term exam IN1900, IN-KJM1900 and MAT-IN1105

Date: 9 october 2019

Attachments: None

Permitted aids: None

- The exam set has 20 multiple choice questions. The maximum score is 25.
- All code in the question text is written in Python 3.
- Most of the questions have one correct answer. A correctly marked answer gives 1 point, wrong or missing answer gives 0 points. There are no negative points for wrong answers, so one should always mark an answer.
- Question 7, 9 and 11 have one or more correct answers. It is given 1 point for each correctly marked answer, -1 for incorrectly marked answers, and 0 for missing answers. The minimum score for each of these questions is 0. One should always mark at least one answer.
- Question 8 has 6 answers. It is given 0.33 points for each correct answer and 0 points for wrong or unmarked answers, maximum 2 points total for the question.
- Since the maximum total score is 25, one can calculate that there must a total of seven correct alternatives for questions 7, 9, and 11. This assumption is correct, but the number of correct alternatives for each of the three questions will not be revealed.

1 Hva skrives ut?

What is printed in the terminal when the following code is run?

```
a = 3
b = a
a = a + b
print(a, b)
```

Select one alternative:

- 6 3
- An error message
- 6 6
- 3 3

Maximum marks: 1

2 Hva skrives ut?

What is printed in the terminal when the following code is run?

```
A = [[-1,1,2],[0,3,-3],[4,5]]  
print(A[1][-1], A[-1][1])
```

Select one alternative:

- 3 4
- 3 5
- An error message
- 2 4

Maximum marks: 1

3 Hva skrives ut?

What is printed when the following code is run?

```
x = 4  
y = 5  
print(x > 4 and y > 4)
```

Select one alternative:

- True
- True and True
- False
- An error message
- False and True

Maximum marks: 1

4 Finn feilen i koden

In which line will the following code fail?

```
import numpy as np
a = [10,8,7]
a_np = np.array(a)
a = a*2
a_np = a_np*2
```

```
for i in range(len(a)):
    print(a[i], a_np[i])
```

Select one alternative:

- a_np = a_np*2
- print(a[i], a_np[i])
- for i in range(len(a)):
- a_np = np.array(a)
- a = a*2

Maximum marks: 1

5 Hva skrives ut?

What is printed when the following code is run?

```
def odd_sum(n):
    s = 0
    for i in range(1,n+1,2):
        s += i
    return s
print(odd_sum(7))
```

Select one alternative:

- 7
- 16
- 23
- An error message
- 9

Maximum marks: 1

6 Hva skrives ut?

What is printed when the following code is run?

```
def f(x, y):  
    if x < y-1:  
        return y - x  
    else:  
        return x - y  
  
print(f(3,4) + f(4,3))
```

Select one alternative:

- 1
- 2
- 3
- 0

Maximum marks: 1

7 Lister og arrayer

One or more of the statements below are correct. Select the correct statements. 1 point is given for a correctly selected alternative, -1 for a wrongly selected alternatives, and 0 points for alternatives not selected. The minimum total score on the question is 0.

Select one or more alternatives:

- We get a list of length 99 if we perform `a = list(range(0, 99, 1))`
- We get a list of length 99 if we perform `a = list(range(0,999,10))`
- A list can contain elements that are themselves lists
- If `a = [1,2,3,4]` then `a[1:1]` is 2
- If `res` is an array of length 5, then `res + res` is an array of length 10
- If `a = [1,2,3,4]` and `b = a+a` then `b` is `[2,4,6,8]`

Maximum marks: 2

8 Boolske uttrykk

Indicate for each row if the result of the logical (boolean) expression is True, False, or if it is incorrect and will give an error message. 1/3 (0.33) points is given for each correct line, maximum 2 points in total.

Please match the values:

	False	True	Gives error message
False == (True == True)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
False or (False or not True)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
not False and True	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
not (False and True)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
True == (False == False)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
False == False	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Maximum marks: 1.98

9 Hvilke påstander er riktige?

Assume that we have defined the following function eq(a,b) and lists x and y:

```
def eq(a, b):
    for i in range(len(a)):
        if a[i] == b[i]:
            return True
    return False
```

```
x = list(range(10))
y = list(range(10,0,-1))
```

One or more of the following statements are correct. Select the correct statements. 1 point is given for a correctly selected alternative, -1 for a wrongly selected alternatives, and 0 points for alternatives not selected. The minimum total score on the question is 0.

Select one or more alternatives:

- The call eq(x+y, y+x) returns the value False
- The call eq(x,y) returns the value True
- The call eq(y, x+y) returns the value False
- The call eq(x,x) returns the value True

Maximum marks: 2

10 Exceptions

The following code is saved in the file "calculate.py":

```
import sys
try:
    a = int(sys.argv[1])
    b = int(sys.argv[2])
except ValueError:
    print("The arguments are not integers")
    sys.exit(0)
except IndexError:
    print("Not enough arguments")
    sys.exit(0)

def h(x, y, gamma):
    v = a * gamma[0] + b * gamma[1]
    ans = f'V0 = {v}'
    return ans

res = h(a, b, [1,2])
print(res)
```

What is printed in the terminal when the program is run in the following way?

Terminal> python calculate.py 2 3

Select one alternative:

- Nothing is printed
- V0 = 8
- The arguments are not integers
- An error message is printed, but not one of those listed here.
- Not enough arguments

Maximum marks: 1

11 Beregning av sum

We want to compute the value of the following expression:

$$s = \sum_{k=m}^n \frac{k-m+1}{k^2+1}$$

Here are some alternatives for computing s:

Alternative A:

```
s = sum((k-m+1.0)/(k**2+1) for k in range(m,n+1))
```

Alternative B:

```
s = 0
for k in range(m,n):
    s += (k-m+1.0) / (k**2 + 1)
```

Alternative C:

```
s = 1/(m**2+1.0)
for k in range(m,n):
    s += (k-m+2.0)/(k**2 + 2*k + 2)
```

Alternative D:

```
s = 0
k = n
while k >= m:
    s = s + (1.0+k-m)/(1+k**2)
    k = k - 1
```

Which of the following statements are correct? 1 point is given for a correctly selected alternative, -1 for a wrongly selected alternatives, and 0 points for alternatives not selected. The minimum total score on the question is 0.

Select one or more alternatives:

- Alternative C is working correctly
- Alternative D is working correctly
- Alternative B is working correctly
- Alternative A is working correctly

Maximum marks: 3

12 **Hva skrives ut?**

What is printed when the following program is run?

```
import numpy as np
x = np.linspace(0,10,11)

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

Select one alternative:

- [0. 2. 4. 6. 8. 10.]
- [1. 2. 3. 4. 5. 6. 7. 8.]
- [2. 3. 4. 5. 6. 7. 8. 9. 10.]
- [0. 2. 4. 6. 8.]

Maximum marks: 1

13 **Hvilken linje mangler?**

Which line is missing in the function `triangle_area(v)` for this code to run without errors?

```
def triangle_area(v):
    ##Missing line goes here ##
    return 0.5*abs(x2*y3-x3*y2-x1*y3+x3*y1+x1*y2+x2*y1)
```

```
def test_triangle_area():
    v1 = (0,0); v2 = (1,0); v3 = (0,2)
    vertices = [v1, v2, v3]
    expected = 1
    computed = triangle_area(vertices)
    tol = 1E-10
    success = abs(expected - computed) < tol
    assert success
```

```
test_triangle_area()
```

Which of the following lines must be added in the function?

Select one alternative:

- `x1, x2, x3 = v[:3]; y1, y2, y3 = v[3:]`
- `x1, y1 = v1; x2, y2 = v2; x3,y3 = v3`
- `x1, x2, x3 = vertices[:3]; y1, y2, y3 = vertices[3:]`
- `x1, y1 = v[0]; x2, y2 = v[1]; x3,y3 = v[2]`

Maximum marks: 1

14 Lister og løkker

The code below defines three lists:

```
a = [n**2 for n in range(1,8,2)]
```

```
b = []  
for i in range(4):  
    b.append((1+2*i)**2)
```

```
c = []  
k = 1  
while k <= 8:  
    c.append(k**2)  
    k+=2
```

Which of the following boolean expressions has value True after the code has run?

Select one alternative:

- a == b == c
- a == b != c
- len(c) > len(a)
- a != b == c
- len(a) != len(b)

Maximum marks: 1

15 **Hvilket funksjonskall?**

The function below implements Newton's method for solving equations on the form $f(x) = 0$. The arguments are as follows:

- f: the function $f(x)$
- df: the derivative $f'(x)$
- x: start value (first guess) for the solution

```
def Newton(f, df, x, tol = 1e-7, max_n = 100):
    n = 0
    while abs(f(x)) > tol and n <= max_n:
        x = x - f(x)/df(x)
        n += 1
    return x, n, f(x)
```

We want to use the function to solve the equation

$$x^2 - 2 = 0$$

Which function call is correct?

Select one alternative:

- x0, n, f = Newton(f(x) = x**2-2, df(x) = 2*x, 2.0)
- x0, n, f = Newton(x**2-2, 2*x, 2.0, 1e-4, max_n=10)
- x0, n, f = Newton(f = x**2-2, df = 2*x, 2.0)
- x0, n, f = Newton(lambda x: x**2-2, lambda x: 2*x, 2.0)

Maximum marks: 1

16 Hvilken linje mangler?

We want the code below to print out values of t and $N(t)$ in two columns. The line that defines the for-loop is missing (before the print statement).

```
from math import exp
def N(t):
    return 50000/(1+9*exp(-0.2*t))
```

```
t = [i*4 for i in range(13)]
pop = [N(t_) for t_ in t]
```

```
##Missing line goes here
print(f'{t:5.1f} {n:8.2f}')
```

Which line must be added to define the for-loop correctly?

Select one alternative:

- for t, n in t, N:
- for t, N(t) in t:
- for t, n in zip(t,pop):
- for t, N(t) in zip(t, pop):

Maximum marks: 1

17 Hva skrives ut?

What is printed in the terminal when the following code is run?

```
def squared(x):
    return x*x*x
```

```
def test_squared():
    y = 2.0
    expected = y**2
    computed = squared(y)
    msg = f'expected {expected}, got {computed}'
    assert abs(computed == expected), msg
```

```
test_squared()
```

Select one alternative:

- False, expected 4.0, got 8.0
- Nothing is printed
- AssertionError: expected 4.0, got 8.0
- NameError: name 'y' is not defined

Maximum marks: 1

18 Exceptions

The program below is saved in a file c2f.py

```
import sys
try:
    C = float(sys.argv[1])
    if C < -271:
        raise RuntimeError
except IndexError:
    print('You need to provide the temperature')
    exit()
except ValueError:
    print('The temperature must be a number')
    exit()
except RuntimeError:
    print('The temperature must be > -271')
    exit()
F = 9/5*C+32
print(f'{C} degrees Celsius is {F} degrees Fahrenheit')
```

What is printed in the terminal when the program is run with the following command?

Terminal> python c2f.py -300

Select one alternative:

- The temperature must be a number
- 273.0 degrees Celsius is -119.7 degrees Fahrenheit
- You need to provide the temperature
- The temperature must be > -271

Maximum marks: 1

19 **Hva skrives ut?**

The file 'messy_records.txt' looks as follows:

```
2007 9.74 Asafa Powell
1996 9.84 Donovan Bailey
2008 9.69 Usain Bolt
1991 9.86 Carl Lewis
1994 9.85 Leroy Burrell
1999 9.79 Maurice Greene
2009 9.58 Usain Bolt
2002 9.78 Tim Montgomery
2005 9.77 Asafa Powell
```

What is printed by the following code?

```
infile = open('messy_records.txt')
fastest = 10.0
for line in infile:
    t = float(line.split()[1])
    if t < fastest:
        fastest = t
        r = line

print(r)
```

Select one alternative:

- 2005 9.77 Asafa Powell
- 9.58
- 1996 9.84 Donovan Bailey
- 9.77
- 2009 9.58 Usain Bolt
- 9.86

Maximum marks: 1

20 Hva skrives ut?

What is printed in the terminal when the following code is run?

```
cnt = 0
a = [1, 2, 3, 4, 5, 6, 4, 2, 3, 2, 10]
for k in range(1, len(a)):
    for j in range(k):
        if a[j] == a[k]:
            cnt += 1
print(cnt)
```

Select one alternative:

- 0
- An error message
- "cnt"
- 5
- 3

Maximum marks: 1