Aarhus Universitet, Science and Technology, Computer Science

Exam

Introduction to Programming with Scientific Applications

Wednesday 27 June 2018, 9:00-11:00

Allowed aid: **None**

The exam questions are answered on the problem statement that is handed in at the end of the exam

Tilladte hjælpemidler: ***Ingen***

Eksamensspørgsmålene besvares på opgaveformuleringen, som afleveres ved eksamenens slutning

Student ID/*årskort* _____

Name/*navn* _____

Information

The exam consists of a set of multiple-choice questions. The questions are answered on the problem statement **that is handed in**. For each question is stated the weight of the question compared to the full exam. Each sub-question has exactly one correct answer. You can select **at most one** answer for each sub-question, by marking the corresponding box with a cross. A sub-question is scored as follows:

- Marking the correct answer gives you 1 point.

- If you do not mark any answer you get 0 points.

- Marking a wrong answer gives you $-\frac{1}{k-1}$ point, where k is the number of answer options.

For a question with weight $v\,\%$ containing n sub-questions, where you score a total of s points, your score for the question will be $\dfrac{s}{n} \cdot v\,\%$. Note that is possible to get a negative score for a question.

*Dette eksamenssæt består af en mængde multiple-choice-opgaver. Opgaverne besvares på opgaveformuleringen **som afleveres**. For hver opgave er angivet opgavens andel af det samlede eksamenssæt. Hvert delspørgsmål har præcist et rigtigt svar. For hvert delspørgsmål, må man vælge **max ét svar** ved at afkrydse den tilsvarende rubrik. Et delspørgsmål bedømmes som følgende:*

- *Hvis du sætter kryds ved det rigtige svar, får du 1 point.*

- *Hvis du ikke sætter nogen krydser, får du 0 point.*

- *Hvis du sætter kryds ved et forkert svar, får du $-\frac{1}{k-1}$ point, hvor k er antal svarmuligheder.*

For en opgave med vægt $v\,\%$ og med n delspørgsmål, hvor man opnår samlet s point, beregnes pointene for besvarelse af opgaven som $\dfrac{s}{n} \cdot v\,\%$. Bemærk at det er muligt at få negative point for en opgave.

Python version

In the following Python refers to Python 3.6.
I det følgende antages at Python refererer til Python 3.6.

Question 1 (Variable names, 5 %)

Which of the below are valid variable names?

Hvilke af nedenstående er lovlige variablenavne?

	Yes/*Ja*	No/*Nej*
x	A	B
for	A	B
_10	A	B
1A_B	A	B
__if__	A	B

Question 2 (Indexing, 5 %)

What is the result of each of the below expressions?

Hvad er resultatet af hvert af nedenstående udtryk?

	0	1	2	3	4	some error/*en fejl*
[1, 2, 3][3]	A	B	C	D	E	F
[3][1, 2, 3]	A	B	C	D	E	F
{1:2, 3:4}[0]	A	B	C	D	E	F
[0][0]	A	B	C	D	E	F
{1, 2, 3}[0]	A	B	C	D	E	F
[[1, 2, 3][1]][0]	A	B	C	D	E	F
{1:2, 3:4}[1]	A	B	C	D	E	F

Question 3 (Slicing, 5 %)

What is the result of each of the below expressions?

Hvad er resultatet af hvert af nedenstående udtryk?

	()	(1)	(2)	(3)	(4)	(1,2)	(2,3)	(3,4)	(1,2,3)	(2,3,4)
(1,2,3,4)[1:3]	A	B	C	D	E	F	G	H	I	J
(1,2,3,4)[3:1]	A	B	C	D	E	F	G	H	I	J
(1,2,3,4)[1:−1]	A	B	C	D	E	F	G	H	I	J
(1,2,3,4)[2:−2]	A	B	C	D	E	F	G	H	I	J
(1,2,3,4)[−4:−2]	A	B	C	D	E	F	G	H	I	J

Question 4 (Boolean operations, 5 %)

What is the result of each of the below boolean expressions?

Hvad er resultatet af hvert af nedenstående boolske udtryk?

	False	True	"False"	"True"	None
False **and** True	A	B	C	D	E
None **or** True	A	B	C	D	E
"False" **and** "True"	A	B	C	D	E
"False" **or** "True"	A	B	C	D	E
"False" **and not** "True"	A	B	C	D	E

Question 5 (Conditionals, 4 %)

```python
x = 1
if x == 1:
    x += 2
    if x == 1:
        x += 3
    else:
        x += 2
else:
    x += 1
print(x)
```

What does the above code print?

Hvad udskriver ovenstående kode?

1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	G	H	I

Question 6 (Loop, 4 %)

```python
x = 1
while True:
    if x > 3:
        break
    x += 1
else:
    1
print(x)
```

What does the above code print?

Hvad udskriver ovenstående kode?

1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	G	H	I

Question 7 (Function, 4 %)

```python
def f(x, y):
    return x ** y

x = 2
y = 3
print(f(y, x))
```

What does the above code print?

Hvad udskriver ovenstående kode?

2	3	4	6	8	9
A	B	C	D	E	F

Question 8 (Recursion, 4 %)

```python
def f(x):
    if x >= 1:
        f(x - 1)
        print(x, end='')
        f(x - 1)

f(3)
```

What does `f(3)` print?

Hvad udskriver `f(3)`?

3211211	1121123	1213121	12321	232
A	B	C	D	E

Question 9 (List comprehension, 5 %)

What is the result of each of the below expressions?

Hvad er resultatet af hvert af nedenstående udtryk?

	1	2	3	4	5	6	7	8	9	10
`sum([x*x for x in [1,2,1]])`	A	B	C	D	E	F	G	H	I	J
`sum([y for x in (1, 2, 3) for y in (1, 2)])`	A	B	C	D	E	F	G	H	I	J
`sum([x*y for x,y in zip([1,2,3],[3,1,1])])`	A	B	C	D	E	F	G	H	I	J
`sum([y for x,y in [(1,2),(3,4),(2,1)]])`	A	B	C	D	E	F	G	H	I	J
`sum([x*x for x in [1,2,3] if x < 3])`	A	B	C	D	E	F	G	H	I	J

Question 10 (`sorted`, 4 %)

```
print(sorted(("pab","kd","defg","s"), key=len, reverse=True))
```

What does the above program print?

Hvad udskriver ovenstående program?

$$['defg', 'kd', 'pab', 's'] \quad \boxed{A}$$

$$['s', 'pab', 'kd', 'defg'] \quad \boxed{B}$$

$$['s', 'kd', 'pab', 'defg'] \quad \boxed{C}$$

$$['defg', 'pab', 'kd', 's'] \quad \boxed{D}$$

$$['pab', 'defg', 'kd', 's'] \quad \boxed{E}$$

Question 11 (`map`, 4 %)

```
print(tuple(map(lambda x : x + x, range(3))))
```

What does the above program print?

Hvad udskriver ovenstående program?

(0, 1, 2)	(3)	(0, 1, 3)	(0, 1, 2 ,3)	(0, 2, 4)	(0, 2, 4, 9)
$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$

Question 12 (Types, 5 %)

What is the resulting type of each of the below expression?

For hvert af nedenstående udtryk hvilken type har resultatet?

	int	float	str	list	tuple	bool
`1 + 2.0`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$
`3 / 2`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$
`3 // 2`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$
`'abc' + 'def'`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$
`'abc' * 3`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$
`len(('a','b'))`	$\boxed{A}$	$\boxed{B}$	$\boxed{C}$	$\boxed{D}$	$\boxed{E}$	$\boxed{F}$

Question 13 (`yield`, 4 %)

```python
def f(x):
    yield 1
    while x > 0:
        yield x
        x -= 1
    yield 1


print(list(f(3)))
```

What list does the above program print?

Hvilken liste udskriver ovenstående program?

[1]	[1,1]	[1,3,2,1,1]	[1,3,3,3,1]	[1,3,2,1,0,1]	[1,3,2,1]
A	B	C	D	E	F

Question 14 (Recursive data, 4 %)

```python
def traverse(T):
    if type(T) is not tuple:
        return T + T
    else:
        return tuple(traverse(c) for c in T)

print(traverse(((3,(2,5)),4)))
```

What does the above program print?

Hvad udskriver ovenstående program?

((3, 3, (2, 2, 5, 5)), 4, 4)   A

(((3, 3), ((2, 2), (5, 5))), (4, 4))   B

(3, 2, 5, 4)   C

(6, 4, 10, 8)   D

((6, (4, 10)), 8)   E

(3, 3, 2, 2, 5, 5, 4, 4)   F

Question 15 (Generator expressions, 4 %)

```python
g = (x * 2 for x in range(1, 6))

print(next(g), next(g), list(g))
```

What does the above program print?

Hvad udskriver ovenstående program?

2 2 [2, 4, 6, 8, 10]	A
2 4 [2, 4, 6, 8, 10]	B
2 4 [6, 8, 10]	C
2 2 [6, 8, 10]	D
2 None []	E

Question 16 (∗ notation, 4 %)

```python
x, y, *z, w = 1, 2, 3, 4, 5, 6
```

What is the value of z?

Hvilken værdi har z?

3	[3]	[3,4,5]	[3,4,5,6]	12
A	B	C	D	E

Question 17 (Sets, 5 %)

What is the value of the following expressions?

Hvilken værdi har følgende udsagn?

	[]	[1]	[2]	[3]	[2,2]	[1,2,3]	[1,2,2,3]
list({1, 2} | {2, 3})	A	B	C	D	E	F	G
list({1, 2} & {2, 3})	A	B	C	D	E	F	G
list({1, 2} − {2, 3})	A	B	C	D	E	F	G
list({1, 2} − {1, 2})	A	B	C	D	E	F	G
list({1, 2} − {1, 2, 3})	A	B	C	D	E	F	G

Question 18 (`zip`, 4 %)

```
list(zip([1,2],zip([3,4],[5,6])))
```

What is the value of the above expressions?

Hvilken værdi har ovenstående udsagn?

[(1, 2), (3, 4), (5,6)]　　A

[1, 3, 5, 2, 4, 6]　　B

(1, 3, 5), (2, 4, 6)　　C

[(1, (3, 5)), (2, (4, 6))]　　D

[((1, 3), 5), ((2, 4), 6)]　　E

Question 19 (`numpy`, 4 %)

```python
import numpy as np
print(np.array([1,2,3]) + np.array([4,5,6]))
print(np.array([1,2,3]) * np.array([4,5,6]))
print(3 * np.array([1,2,3]))
print(np.array([1,2,3]) @ np.array([4,5,6]))
```

What does the above program print?

Hvad udskriver ovenstående program?

```
[1 2 3 4 5 6]
32
[1 2 3 1 2 3 1 3 3]
4
```
A

```
[1 2 3 4 5 6]
[ 4 10 18]
[1 2 3 1 2 3 1 3 3]
4
```
B

```
[5 7 9]
[ 4 10 18]
[3 6 9]
32
```
C

```
[1 2 3 4 5 6]
[ 4 10 18]
[3 6 9]
32
```
D

Question 20 (`lambda`, 4 %)

```python
def f(g, h, L):
    return [g(x) if x % 2 == 0 else h(x) for x in L]

print(f(lambda x : 3 * x, lambda x : 2 * x, [1, 2, 3, 5]))
```

What list does the above program print?

Hvilken liste udskriver ovenstående program?

[1,0,1,1]	[3,6,9,10]	[3,4,9,15]	[2,6,6,10]	[2, 6, 6, 15]
A	B	C	D	E

Question 21 (Assertions, 4 %)

```python
def f(x):
    assert type(x) == int

    return 3 * x
```

What does each of the below function calls return?

Hvad returnerer hvert af nedenstående funktionskald?

	6	6.0	'222'	AssertionError
f(2)	A	B	C	D
f(2.0)	A	B	C	D
f('2')	A	B	C	D

Question 22 (Inheritance, 5 %)

```python
class A:
    def say(self):
        print("Hello")

class B:
    def greet(self):
        print("Welcome")

class C(A, B):
    pass
```

What does each of the below metode calls print?

Hvad udskriver hvert af nedenstående metodekald?

	Hello	Welcome	AttributeError
A().say()	A	B	C
B().say()	A	B	C
C().say()	A	B	C
A().greet()	A	B	C
B().greet()	A	B	C
C().greet()	A	B	C

Question 23 (Decorator, 4 %)

```python
def d(x):
    def y(z):
        print(type(x))
        x(z+z)

    return y

@d
def f(x):
    print("value = " + str(x))

f(21)
```

What does the above program print?

Hvad udskriver ovenstående program?

```
<class 'int'>
value = 21
```
A

```
<class 'int'>
value = 42
```
B

```
<class 'function'>
value = 21
```
C

```
<class 'function'>
value = 42
```
D

```
<class 'str'>
value = 21
```
E

```
<class 'str'>
value = 42
```
F