

CANDIDATE

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TEST

Quiz 5

Subject code	
Evaluation type	
Test opening time	13.03.2024 07:00
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Grade deadline	
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Question	Status	Marks	Question type
1.1	Correct	1/1	Multiple Response
1.2	Correct	1/1	Multiple Choice
1.3	Correct	1/1	True / False
1.4	Correct	1/1	Text Entry
1.5	Correct	1/1	Multiple Response
1.6	Correct	1/1	Multiple Response
1.7	Correct	1/1	Multiple Response
2.1	Correct	1/1	True / False
2.2	Correct	1/1	Multiple Response
2.3	Correct	1/1	Multiple Choice

1.1 Suppose $f:S \rightarrow S$ and $g:S \rightarrow S$ are bijections.

Which of the following are true for all such functions? **Select all that apply**

(f°g)⁻¹ always exists and (f°g)⁻¹ = (f⁻¹)°(g⁻¹)

(f∘g) ⁻¹ always	exists and	$(f \circ a)^{-1} =$	$(a^{-1})\circ (f^{-1})$



(f;g) \leftarrow always exists and (f;g) \leftarrow = (f \leftarrow);(g \leftarrow)

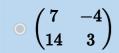




None of the above

Let
$$A=egin{pmatrix} 3 & 1 \ 4 & 1 \end{pmatrix}$$

Which of the following matrices is $AA - 2A^{T}$?





- $\bigcirc \begin{pmatrix} 3 & -1 \\ 8 & -1 \end{pmatrix}$
- $egin{pmatrix} 3 & -7 \\ 14 & -1 \end{pmatrix}$
- None of the above

- **1.3** Suppose T(n) is defined recursively as:

 - T(0) = 1T(n) = 3T(n/3) + O(n)

True or false: $T(n) \in O(n)$





True

- **1.4** Suppose f,g: $\{a,b\}^* \rightarrow \{a,b\}^*$ are defined recursively as follows:
 - f(λ)=a
 - $g(\lambda)=b$
 - f(aw) = f(w)g(w)
 - f(bw) = g(w)f(w)
 - g(aw)=g(bw)=f(w)

What is f(bba)?



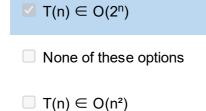


1.5 Consider the following code snippet:

myFunc(n):
if n==0:
return 1
else:
return myFunc(n-1) + myFunc(n-1)

Which of the following hold with regard to the running time $\mathsf{T}(\mathsf{n})$ of this code Select all that apply

 \square T(n) \subseteq O(log n)





 \Box T(n) \in O(n)

5/9

1.6 Consider the following code snippet:

myFunc(n):	
if n==0:	
return 1	
else:	
return 2*myFunc(n-1)	

Which of the following hold with regard to the running time $\mathsf{T}(\mathsf{n})$ of this code Select all that apply

$ ightharpoonup T(n) \in O(n)$	•
$ ule{\hspace{0.1cm}}$ $T(n)\in O(2^n)$	•
$T(n) \in O(n^2)$	•

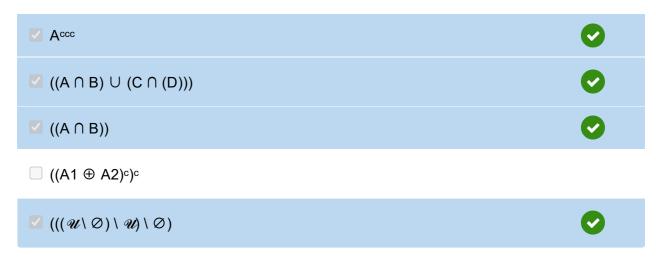
- None of these options
- \square T(n) \subseteq O(log n)

- 1.7 Recall the definition of a valid expression for the proof checker:
 - \varnothing and $\mathcal U$ are valid expressions
 - Any single letter A-Z or a-z is a valid expression
 - If E is a valid expression, then:
 - o (E) is a valid expression
 - o Ec is a valid expression
 - If E₁ and E₂ are valid expressions, then:
 - (E₁ ∩ E₂) is a valid expression
 - (E₁ U E₂) is a valid expression
 - ∘ (E₁ \ E₂) is a valid expression
 - ∘ (E₁ ⊕ E₂) is a valid expression

Based on the above definition, which of the following are valid expressions?

Select all that apply:

 \square ((A \cup a) \cap (B \cup b) \cap (C \cup c)) \circ



- **2.1** Suppose T(n) is defined recursively as:
 - T(0) = 1
 - T(n) = 3T(n-3) + O(n)

True or false: $T(n) \in O(2^n)$

False



2.2 Consider the following code fragment that works on an array:

myFunc(A, lo, hi):	
if lo + 1 >= hi:	
return	
j = (lo + hi) / 2	
if A[lo] < A[hi]:	
myFunc(A, lo, j)	
myFunc(A, j, hi)	
else:	
myFunc(A, j, hi)	
myFunc(A, lo, j)	
for $i \in [lo, hi)$:	
print(A[i])	

In terms of n = hi - lo, which of the following hold for the running time T(n) of this code? Select all that apply:

- \square T(n) \in O(n)
- \square T(n) \in O(1)
- $T(n) \subseteq O(2^n)$



 $I(n) \subseteq O(n^2)$



 \square T(n) \subseteq O(log n)





- 2.3 Consider a subset, EXP, of valid expressions (see Question 1.7), defined recursively as follows:
 - \varnothing and $\mathcal U$ are elements of EXP
 - X,Y,Z ∈ EXP
 - If $E \in EXP$, then:
 - ∘ (E) ∈ EXP
 - ∘ Ec∈ EXP
 - If E_1 , $E_2 \in EXP$, then:
 - \circ (E₁ \cap E₂) \in EXP
 - ∘ $(E_1 \cup E_2) \in EXP$

Consider dual: EXP → EXP defined recursively as follows:

- dual(∅) = *U*
- dual(\mathcal{U}) = \emptyset
- dual(X) = X, dual(Y) = Y, dual(Z) = Z
- If $E \in EXP$, then
 - dual((E)) = (dual(E))
 - o dual(Ec) = dual(E) c
- If E_1 , $E_2 \in EXP$, then
 - ∘ dual($(E_1 \cap E_2)$) = (dual $(E_1) \cup dual(E_2)$)
 - ∘ dual($(E_1 \cup E_2)$) = (dual $(E_1) \cap dual(E_2)$)

What is dual($((X \cap Y^c) \cup \mathcal{U})$)?

Select one alternative:

- \bigcirc ((X $^{\circ}$ \cap Y) \cup \emptyset)
- \bigcirc Ø





- \bigcirc ((X \circ \cup Y) \cap \emptyset)
- None of the above