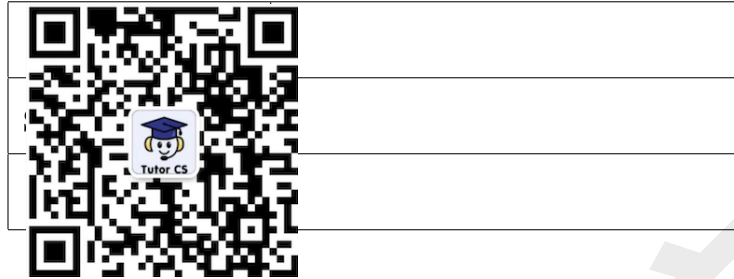


程序代写代做 CS编程辅导



University of New South Wales
School of Computer Science and Engineering
Foundations of Computer Science (COMP9020)

FINAL EXAM — Session 1, 2017

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This paper must be submitted and cannot be retained by the student

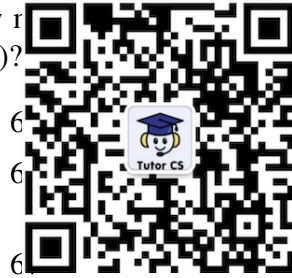
Instructions:

- Ensure you enter your correct name and student number above!
- This exam paper contains 10 multiple-choice questions (pages 1-3) plus 5 open questions (pages 4-8).
Each multiple-choice question is worth 4 marks ($10 \times 4 = 40$).
Each open question is worth 12 marks ($5 \times 12 = 60$).
Total exam marks = 100.
- Only use a blue or black pen. All answers must be recorded in this paper.
- For the multiple-choice questions, tick **one** box for your answer directly (each multiple-choice question has only one correct answer).
To make a correction, tick *all* boxes, then *circle* one box for your answer.
- For the open questions, write your answer in the space provided (if you need more space, you can write on the back of the sheet).
- A separate white booklet is provided for scratch work only. **Do not write your answers in the Examination Answer Book, it will not be marked.**
- Time allowed – 120 minutes + 10 minutes reading time.
- The exam is *closed book*. Reference materials are not allowed, apart from one A4-sized sheet (double-sided is ok) of your own notes.
- Number of pages in this exam paper: 8 (in addition to this cover sheet).



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1. How many integers in the interval $[-100, 100]$ are divisible by 5 **or** 7 (or both)?



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2. Consider the alphabets $\Sigma = \{s, e, a\}$ and $\Psi = \{a, r, t\}$. How many words are in the set $\{\omega \in (\Sigma \setminus \Psi)^* : \text{length}(\omega) \leq 2\}$?

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3. Which of the following is **not** a correct equivalence?

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$$\neg A \vee B \equiv \neg(B \wedge \neg A)$$

$$A \wedge \neg B \equiv \neg(B \vee \neg A)$$

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$$\neg(A \Rightarrow B) \equiv \neg B \wedge A$$

4. Consider the functions $f : \mathbb{N} \rightarrow \{0, 1, 2\}$ and $g : \{0, 1, 2\} \rightarrow \{0, 1, 2\}$ defined by

$$f(x) = x \bmod 3$$

$$g(x) = |x - 2|$$

Which of the following statements is true?

$$f \circ f \neq f$$

$$g \circ g = \text{Id}_{\{0, 1, 2\}}$$

$f \circ g$ is **not** onto

$g \circ f$ is **not** onto



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5. Consider a poset on $S = \{1, 2, 3, 4, 6, 12\}$ defined by

$x \leq y$ if $x \mid y$ (i.e., x is a divisor of y)

Which of the following is true?

lcm($\{4, 6, 12\}$) = 12

(S, \leq) is a lattice

$1 < 3 < 2 < 6 < 4 < 12$ is a topological sort of (S, \leq)

6. All connected graphs with n vertices and k edges satisfy

$$n \geq k + 1$$

$$n \geq k$$

$$n \leq k$$

$$n \leq k + 1$$

7. We would like to prove that $P(n)$ for all $n \geq 0$.

Which of the following conditions imply this conclusion?

$P(0)$ and $\forall n \geq 1 (P(n) \Rightarrow P(n+1))$

$P(0)$ and $P(1)$ and $\forall n \geq 1 (P(n) \wedge P(n+1) \Rightarrow P(n+2))$

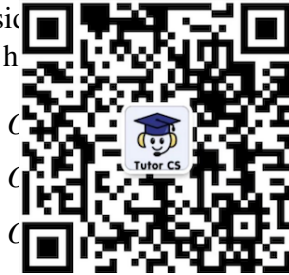
$P(0)$ and $P(1)$ and $\forall n \geq 0 (P(n) \wedge P(n+1) \Rightarrow P(n+2))$

$P(0)$ and $P(1)$ and $\forall n \geq 1 (P(n) \Rightarrow P(n+2))$



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8. Consider a recurrence relation defined by $T(1) = 1$ and $T(n) = 4 \cdot T(\frac{n}{2}) + n$.
This has a time complexity of $O(2^n)$.



$O(2^n)$

9. Let $S = \{1, 2, 3\}$ and $\mathbb{B} = \{0, 1\}$.
How many different *onto* functions $f : S \rightarrow \mathbb{B}$ are there?

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10. Which of the following is true for all A, B ?

$P(A \cap B|B) = P(A|B)$

$P(A \cap B) = P(B) \cdot P(B|A)$

$P(A \cup B) \geq P(A) + P(B)$

$P(A|B) + P(A|\bar{B}) = 1$

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11. Consider the following formulae:



$$\begin{aligned} &= \neg(A \Rightarrow (B \wedge C)) \\ &= \neg A \vee C \end{aligned}$$

- (a) True or False? Is the formula in *disjunctive* normal form (DNF).
- (b) For all ϕ and ψ , if $\neg B$ is a logical consequence of ϕ and ψ .
- (c) Is the formula a tautology (i.e., always true)? **Explain your answer.**

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12. Prove holds: relations $\mathcal{R}_1 \subseteq S \times S$ and $\mathcal{R}_2 \subseteq S \times S$ the following



symmetric, then $\mathcal{R}_1 \setminus \mathcal{R}_2$ is symmetric.

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13. The F_i defined as follows:



$F_1 = 1; F_i = F_{i-1} + F_{i-2}$ for $i \geq 3$

Write a program or the statement that every *third* Fibonacci number (the F_i where i is a multiple of 3) is even (i.e., divisible by 2).

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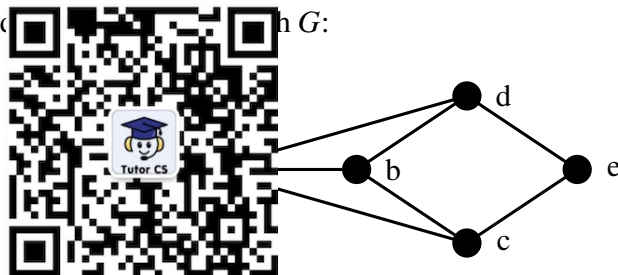
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14. Consider the graph G :



- (a) Give all 3-cliques of G .
- (b) What is the chromatic number $\chi(G)$ of G ? **Explain your answer.**
- (c) What is the maximal number of edges that can be added to G such that G remains planar? **Explain your answer.**

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15. Consider a deck of cards containing 2 jacks and 4 aces. One card is randomly drawn at a time. Calculate the expected number of draws until the first ace is drawn:

- (a) if the card is not put back into the deck after each drawing;
(b) if the card is put back into the deck after each drawing.

Briefly explain your answers.

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— END OF EXAM —

