

Student to complete:

Family name	
Other names	
Student number	

MATH221
Mathematics for Computer Science
Wollongong

In-Session Test 2-A: May 23rd
Autumn Session 2018

Exam duration 60 minutes

Aids supplied None

This exam is worth 20% of your final grade for MATH221.

Answers should be written on the exam paper in the spaces provided. **SHOW ALL YOUR WORK.**

This exam paper must not be removed from the exam venue

Questions

1. Which of the following is possible?
 - (a) A graph with 5 vertices, 5 edges and total degree 10.
 - (b) A graph with 5 vertices of degrees 1, 1, 2, 2 and 3.
 - (c) A simple graph with 6 vertices of degrees 1, 2, 2, 4, 6 and 6.
 - (d) A simple graph with 5 vertices of degrees 2, 2, 2, 5 and 5.
 - (e) None of the above.
2. Which of the following about a tree graph G is false?
 - (a) G has no loops.
 - (b) G has no closed circuits.
 - (c) The number of edges of G exceeds the number of vertices of G by one.
 - (d) G has no parallel edges.
 - (e) The number of vertices of G exceeds the number of edges of G by one.
3. Draw a graph with 7 vertices that has an Eulerian circuit.
4. Let A be the set of even integers and B be the set of prime numbers less than 5. Write the set $\{3\}$ in terms of A and B .
5. Let $A = \{a, b, c, \{\emptyset\}\}$. Which is true?
 - (a) $\{\emptyset\} \subseteq A$ and $\{a, b, c\} \in \mathcal{P}(A)$.
 - (b) $a \in \mathcal{P}(A)$ and $\emptyset \in \mathcal{P}(A)$.
 - (c) $\{\emptyset\} \subseteq \mathcal{P}(A)$ and $\{\{b\}\} \in \mathcal{P}(A)$.
 - (d) $\emptyset \in A$ and $\{\{\emptyset\}\} \in \mathcal{P}(A)$.
 - (e) $\{a, b, c\} \subseteq A$ and $\{\{\emptyset\}\} \in \mathcal{P}(A)$.
6. Which is true of $A = \{n^2 - 2n : n \in \mathbb{Z}\}$ and $B = \{m^2 + 2m : m \in \mathbb{Z}\} \cup \{1\}$?
 - (a) $A \cap B = \emptyset$.
 - (b) $A \cup B = \mathbb{Z}$.
 - (c) $A \subseteq B$ and $A \neq B$.
 - (d) $B \subseteq A$ and $B \neq A$.
 - (e) $A = B$.
7. Using the Binomial Theorem, we find that $\sum_{k=1}^{15} (-1)^k \binom{15}{k} 7^{15-k} =$
 - (a) 6^{15}
 - (b) 7^{15}
 - (c) $7^{15} - 6^{15}$
 - (d) $6^{15} - 7^{15}$
 - (e) None of the above.
8. Consider the alphabet $A = \{a, b, c, d\}$. How many A -sequences of length $n \geq 2$ contain exactly two letters a ?

(a) $n(n-1)3^{n-2}$

(b) $\binom{n}{2}4^{n-2}$

(c) $3 \cdot 2^{n-2}$

(d) $\binom{n}{2}3^{n-2}$

(e) None of the above.

9. The value of $\binom{10}{0} + \binom{10}{1} + \cdots + \binom{10}{10}$ is

(a) 10^2

(b) 2^{10}

(c) $10 \cdot 21$

(d) 2^{11}

(e) None of the above.

10. Which is an onto function from $A = \{1, 2, 3\}$ to $B = \{a, b, c\}$?

(a) $\{(a, 1), (b, 3), (c, 2)\}$

(b) $\{(1, a), (2, b), (2, c)\}$

(c) $\{(1, a), (3, b), (2, c)\}$

(d) $\{(1, a), (2, b), (3, b)\}$

(e) None of the above.

11. On \mathbb{R} , consider the equivalence relation $R = \{(x, y) : x - y \in \mathbb{Z}\}$. Which is false?

(a) $[\pi] \cap [\sqrt{2}] = \emptyset$

(b) $[\pi] \cup [2] = \mathbb{R}$

(c) $[n] \cap \mathbb{Z} \neq \emptyset \forall n \in \mathbb{Z}$.

(d) $[q] \subseteq \mathbb{Q} \forall q \in \mathbb{Q}$.