

KING SAUD UNIVERSITY

COLLEGE OF COMPUTER & INFORMATION SCIENCES DEPT OF COMPUTER SCIENCE

CSC281 Discrete Mathematics for CS Students

Second Semester 1439/1440 AH First midterm Examination:

(Spring 2019) Sun 24.02.2019 C.E. (Time: 5:30-7:00 pm)

Dr. Aqil Azmi

Instructor: Name:





1. [Marks 12]

Determine the Truth of the following propositions for the given universe of discourse. NOTE: $\mathbb N$ (set of non-negative integers); $\mathbb Z$ (set of all integers); and R (set of real numbers).

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	N	Z	R
$\forall x \exists y \ 2x - y = 0$	true	true	true
$\forall \overrightarrow{x} \exists y \ x - 2y = 0$	false	true X	true
$\forall x \ (x < 10) \longrightarrow (\forall y \ y < x \longrightarrow y < 9)$	false x	FARE	true x
$\forall x \exists y \ [(y > x) \land \exists z \ (y + z = 100)]$	False	False x	false X

/2. [Marks 8]

Show that $(p \land q) \rightarrow (p \lor q)$ is a tautology.

$$(P \land q) \rightarrow (P \lor q) \equiv \neg (P \land q) \checkmark (P \lor q)$$

$$\equiv \neg P \lor \neg q \lor P \lor q$$

$$\equiv (\neg P \lor P) \lor (\neg q \lor q)$$

$$\equiv \top \lor \top$$

$$\equiv \top$$

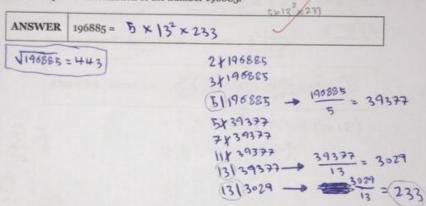
3. [Marks 10]

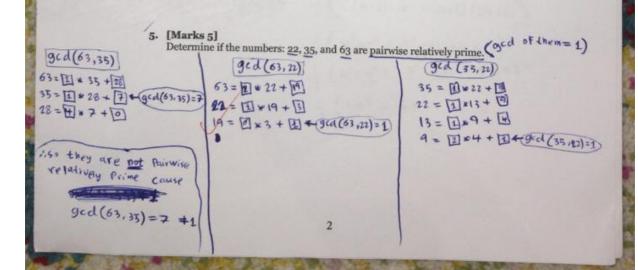
Let $A \times B = \{(1,2),(1,3),(1,7),(2,2),(2,3),(2,7)\}$. Write the following sets: (a) $A \cup B = \{1,2,3,7\}$

(c)
$$A - B = \{13\}$$

4. [Marks 10]

Find the prime factorization of the number 196885.





6. [Marks 15=5+10]

Solve the following summation. NOTE: $\sum_{k=1}^{n} k^2 = n(n+1)(2n+1) / 6$.

a. Calculate the sum:
$$\sum_{k=1}^{3} \left(\sum_{m=1}^{3} mk - \sum_{k=1}^{K} mK \right)$$

$$\sum_{k=1}^{3} \left(\sum_{m=1}^{3} mk - \sum_{m=1}^{K} mK \right)$$

$$\sum_{k=1}^{3} \left(K \sum_{m=1}^{3} m - K \sum_{m=1}^{K} m \right)$$

$$\sum_{k=1}^{3} \left(K \times \frac{3}{2} (4) - K \times \frac{-K(-K+1)}{2} \right)$$

$$\sum_{k=1}^{3} \left(K \times \frac{3(4)}{2} - K \times \frac{-K(-K+1)}{2} \right)$$

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b. Find the general formula for the summation: $\sum_{k=1}^{n} \left(\sum_{m=k}^{n} k \right)$.

ANSWER Formula = (KKH) KKH KKH

$$\sum_{k=1}^{K=1} \left(\sum_{i,j}^{M=1} K - \sum_{i=1}^{M=1} K \right)$$

$$n \underset{K}{\overset{K=1}{\sum}} K + \underset{N}{\overset{K=1}{\sum}} K^{2}$$

$$= \frac{1}{2} \left(n^2 (n+1)^{\circ} + n(n+1)(2n+1) \right)$$

$$= \frac{1}{2} \left(3n^3 + 4n^2 + n \right)$$

$$n * \frac{n(n+1)}{2} + \frac{n(n+1)(2n+1)}{2}$$

$$(n+1)$$
 + $(n+1)$ + $(n+1)$ (2n+1)

$$\frac{1}{2} \left(N^{3} + n^{2} + (n^{2} + n) (2n + 1) \right)$$

$$\frac{1}{2} \left(N^{3} + n^{2} + 2n^{3} + 2n^{2} + n^{2} + n \right)$$

$$\frac{1}{2} \left(3n^{3} + 4n^{2} + n \right)$$



7. [Marks 10]

Given a sequence. If
$$\sum_{i=1}^5 a_i = 7$$
, and $\sum_{i=6}^{12} a_i = 25$. Calculate $\sum_{i=1}^{12} (1-a_i)$.

$$\sum_{i=1}^{12} (1 - a_i) = \sum_{i=1}^{n} 1 - \sum_{i=1}^{12} a_i$$

$$= \sum_{i=1}^{12} 1 - \left(\sum_{i=1}^{n} a_i + \sum_{i=1}^{12} a_i\right)$$

$$= 12 - (7 + 25)$$

$$= -20$$

8. [Marks 10]

Express the gcd(65, 1326) using the linear combination of its arguments.

(ged (63, 1326)



9. [Marks 20]

Solve using the Chinese Remainder Theorem: $x \equiv 2 \mod 6$ and $x \equiv 4 \mod 13$.

	ANSWER	x =	76		
,	= 2 mad	m 11	Pairwise	X	

ged (13,6) 13=四+6+1日本

m = 6 * 13 (m= 78)

$$M_1 = \frac{m}{m_1} = \frac{78}{6} = 13$$

$$M_2 = \frac{m}{m_2} = \frac{78}{13} = 6$$

 $M_1 y_1 \equiv 1 \mod m, \qquad M_2 y_2 \equiv 1 \mod m_2$ $13 y_1 \equiv 1 \mod 6 \qquad 6 y_2 \equiv 1 \mod 13$ 14, = 1 mod6 (y1=1)

$$M_1 y_2 \equiv 1 \mod m_2$$

$$6 y_2 \equiv 1 \mod 13$$

$$y_2 = 11$$

0 < X < 78



$$X = (a, M_1 y_1 + a, M_2 y_2) \mod m$$

$$X = \left[(2 \times 13 \times 1) + (4 \times 6 \times 11) \right] \pmod 78$$

$$X = \left[26 + 204 \right] \mod 78$$

$$X = 290 \mod 78$$

$$X = 56 \mod 78$$

in genera solution