KING SAUD UNIVERSITY

COLLEGE OF COMPUTER & INFORMATION SCIENCES
DEPT OF COMPUTER SCIENCE

CSC281 Discrete Mathematics
Practice for the Midterm
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1. Let P(x) = "x drives car", Q(x,y) = "x drives y". Express the following using P, Q and quantifiers.
   - **a.** Ahmad drives car.
   - **b.** Ali does not drive truck.
   - **c.** There is something that Omar does not drive.
   - **d.** There is something that someone does not drive.
   - **e.** Express P in terms of Q.

2. Consider set $A = B \cup \{\varnothing\}$, where B is some set. Express the cardinality of P(*A*) in terms of P(*B*).

3. Calculate $\sum_{k=1}^{n} (-1)^k k$.

4. Calculate $\sum_{k|n} k$, for n = 20, 27, and 30.

5. We define the function *n*!! as, $n!! = n \cdot (n-2) \cdot (n-4) \cdots \begin{cases} 1, & n \text{ odd} \\ 2, & n \text{ even} \end{cases}$.
Express *n*! in terms of *n*!!. Express *n*!! in terms of product notation.

6. Prove that all the odd primes are of form 4*n* + 3.

7. What is gcd(10!, 49).

8. Calculate $\sum_{r=1}^{2n} \left(3r^2 - \frac{1}{2}\right)$.

9. Let functions *f* and *g* both be $\mathbb{R} \to \mathbb{R}$. Assume $f(x) = x + 1, g(x) = \sqrt{x^2 - 1}$.
Find $f \circ g, g \circ f, f \circ f, f(x + f(x^2))$.

10. Complete A x B = {(1,2), (1,3), (2,2), (2,3), (5, ?), (?, ?)}.

11. Show using induction 3 | (n^3 – n).

12. What is wrong with the following proof of 2+2=5,

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\begin{aligned}
0 &= 0 \\
20 - 20 &= 25 - 25 \\
(4 \times 5) - (4 \times 5) &= (5 \times 5) - (5 \times 5) \\
4 \times \cancel{(5 - 5)} &= 5 \times \cancel{(5 - 5)} \\
4 &= 5 \\
2 + 2 &= 5
\end{aligned}
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