Discrete mathematics 1 (Spring 2020): List of theorems with proofs for the exam

Sets and relations

1. The properties of set union (5 properties, slide 18, Sets)
    - Sample question: State and prove three properties of set union.
2. The properties of set intersection (5 properties, slide 21, Sets)
    - Sample question: State and prove three properties of set intersection.
3. The Distributive properties of set union and intersection (2 properties, slide 22, Sets)
4. The properties of set complement (8 properties, including De Morgan's Laws, slide 24, Sets)
    - Sample question 1: State and prove four properties of the set complement.
    - Sample question 2: State and prove De Morgan's Laws for sets.
5. Proposition stating that the composition of binary relations is associative (first statement in 'Properties of the composition of relations', slide 12, Relations)
6. Proposition about the inverse of the composition of binary relations (second statement in 'Properties of the composition of relations', slide 12, Relations)
7. Theorem stating that the composition of functions is also a function (first statement in 'Properties of the composition of functions', slide 28, Relations)
8. Theorem stating that the composition of injective functions is also injective (first statement in 'Properties of the composition of functions', slide 28, Relations)

Complex numbers

9. Proposition about calculating the quotient of complex numbers in algebraic form (slide 13, Complex numbers)
10. Properties of conjugation and the absolute value of complex numbers (slide 14, Complex numbers)
    - Sample question: Write down and prove four properties of the conjugation and/or absolute value of complex numbers.
11. De Moivre's formula for multiplying complex numbers in polar form (first statement in the theorem De Moivre's formulas', slide 19, Complex numbers)

Combinatorics

12. Theorem about the number of permutations without repetition (slide 6, Combinatorics)
13. Theorem about the number of permutations with repetition (slide 9, Combinatorics)
14. Theorem about the number of variations without repetition (slide 11, Combinatorics)
15. Theorem about the number of variations with repetition (slide 13, Combinatorics)
16. Theorem about the number of combinations without repetition (slide 15, Combinatorics)
17. Theorem about the number of combinations with repetition (slide 18, Combinatorics)
18. Binomial theorem (slide 21, Combinatorics)
19. Polynomial theorem (slide 24, Combinatorics)

Graphs

20. Theorem about the sum of the degrees of all vertices in a graph (slide 6, Graphs)
21. Statement about creating a path from a walk between two vertices of a graph (slide 17, Graphs)
22. Theorem called 'Equivalent characterisations of trees' (slide 19, Graphs)

23. Statement about vertices of degree 1 in finite acyclic graphs (slide 22, Graphs)
24. Theorem called 'Equivalent characterisations of trees 2 - using the number of edges' (slide 23, Graphs)
25. Statement about spanning trees in finite connected graphs (slide 26, Graphs)
26. Statement about a lower bound on the number of cycles in a finite connected graph (slide 27, Graphs)
27. Theorem about the existence of a closed Euler trail (slide 30, Graphs)
28. Euler-formula (slide 36, Graphs)
29. Statement about an upper bound on the number of edges in simple planar graphs (slide 37, Graphs)
30. Statement about an upper bound on the minimal degree in simple planar graphs (slide 38)