

CMSC 57 Discrete Mathematical Structures in Computer Science II
Distribution Models of Counting

On your paper, write the exercise number and title, your name, student number, an animal emoticon of how you feel at the moment (you may add in some words), section, and the date today.

Read and discuss the problem and the possible solutions with your partner before writing on your papers. Answer each item as neatly as possible. Minimize erasures. Review your solutions before submitting your papers. Do not discuss your work with any other group.

Show your complete solutions. Explain how you arrived at your answers.

1. In an assault mission to the Elder Hekate's shadowrealm where the *Tree of Life* Yggdrasil stands, the *Cat* Elder Bastet (only) has 96 hired mercenaries and 55 battle Lynxes to deploy. In how many ways can Bastet distribute the Lynxes to the mercenaries if one mercenary is only entitled to have one Lynx escort to maximize the assault coverage? (The Lynxes can be distinguished by their fur color and spots)
2. Having received orders from Bastet, some of the mercenaries fear for their lives since some of them will receive no escort Lynx and some even felt that one escort Lynx is not enough (since Hekate's shadowrealm is full of Torc Alta – the wereboars). So what they did was that some of them tricked the Lynxes to eat hallucinogenic sardines before the mission and the Lynxes ended up escorting the mercenary they wanted to escort. In how many ways can the Lynxes be distributed to the mercenaries if one mercenary can have as many escort Lynx as possible?
3. In how many ways can the *Jackal* Elder Anubis (son of Bastet) send a squad of 18 distinct Anpus in his command to chase the visitors (from the future) in Danu Talis if only 6 numbered vimanas (flying saucers) are available and each can only carry 3 Anpu?
4. In how many ways can Anubis send the squad of 18 Anpus in #3 if the vimanas are **not** numbered?
5. The *Spider* Elder Aerop-Enap and the *Sorceress* Perenelle Flamel joined together, despite their previous battles with each other, to stop the deeds of the Dark Elders. They are planning to smuggle 500 of Aerop-Enap's identical broodlings (children) via boat by putting them into 7 differently colored (ROYGBIV) trash bags. A trash bag may hold as much as 700 broodlings. In how many ways can they distribute the broodlings to the bags?

6. Aerop-Enap and Perenelle Flamel decide to safekeep 150 of the 500 broodlings to the red and orange trash bags, with the red and orange bags holding at least 50 broodlings each; and the remaining 350 to the YGBIV bags with each bag holding at least 30 broodlings each. In how many ways can they distribute the broodlings to the bags?
7. In how many ways can the *Alchemyst* Nicholas Flamel, safe keep 19 distinct Danu Talis (now known as Atlantis) relics into 7 distinct enchanted crates if each enchanted crate can hold as many relics as it can?
8. In how many ways can Nicholas Flamel, safe keep the relics in #7 if the swords Excalibur, Clarent, Joyeuse, and Durendal are to be safe kept in separate crates each and the remaining relics to the remaining enchanted crates?
9. In how many ways can Dr. John Dee (the *Immortal* enemy of the Flamels) give electronic cards to his 500 minions if each card has an ID that consists of an uppercase letter from A-M; followed by one of the four legendary swords in #8; then by a lowercase letter from N-Z, then by one of the insignia of the once great 12 Archons?
10. The *Witch* of Endor (and Elder, also *Master* of Air), Zephaniah has 14 different mirrors in her store. In how many ways can she arrange the mirrors if she is to put them on 4 walls if 1 wall will have 2 mirror sand the remaining 3 walls will have 4 mirrors each?
11. The *Bird* Elder Morrigan, having been freed by the *Sorceress*, Perenelle Flamel, at Alcatraz, sends her Great 9 Birds of Prey to scout San Francisco to look for any Dark Elder activity. She decides to send them to groups of 3s to the North, East, and West of SF since she got the South already covered by herself. Furthermore, she decides to send the *Eagle* and the *Osprey* to the North; the *Kite* and the *Buzzard* to the East; and the *Hawk* to the West; leaving behind the *Harrier*, *Vulture*, *Falcon*, and *Owl* for distribution. How many ways can she distribute the remaining Birds of Prey?
12. In order to prepare the *Elixir* of Life, the *Alchemyst* Nicholas Flamel needs to prepare 75 identical Yggdrasil twigs and dissolve them to 10 flasks containing different acidic concoctions. In how many ways can Flamel dissolve the twigs to the concoctions if each concoction should contain at least 6 Yggdrasil twig?