

Name: Solutions**Directions:** Show all work. No credit for answers without work.

1. [2 parts, 2.5 points each] A computer game has 5 different personas: elves, dwarfs, goblins, leprechauns, and minotaurs. There are 4 different skill categories: magic, weapons, construction, and farming. Expertise in each skill area is a binary property: a character is either an expert in an area or not.
- (a) Players create a character by selecting a persona and a single area of expertise. How many ways are there to form a character?

Rule of Product

① Choose persona $n_1 = 5$ ② Choose skill category $n_2 = 4$

$$\text{So total \# (ways to create a character)} = 5 \cdot 4 = \boxed{20}$$

- (b) During the game, a character may gain or lose expert status in the various areas of expertise. How many different types of characters are possible throughout the game?

Rule of Product: Build a character w any subset of skills

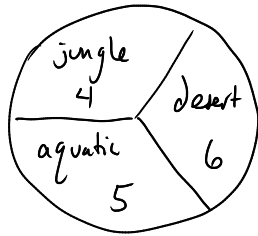
① Choose persona $n_1 = 5$ ② Is expert in magic? $n_2 = 2$ ③ " " " weapons? $n_3 = 2$ ④ " " " construction? $n_4 = 2$ ⑤ " " " farming? $n_5 = 2$

$$\text{So total \# characters} = 5 \cdot 2^4 = \boxed{80}$$

2. [2 parts, 2.5 points each] A zoo has 4 exhibits in the jungle zone, 6 exhibits in the desert zone, and 5 exhibits in the aquatic zone.

(a) Standard admission to the zoo includes a complementary photo of the visitor in an exhibit of the visitor's choice. How many ways can a visitor take the photo?

Use Rule of Sum:



$$4 + 6 + 5 = \boxed{15 \text{ ways}}$$

(b) Deluxe admission includes an additional photo. The two photos must be taken at exhibits in different zones. How many ways can a visitor with a deluxe admission choose the exhibits for the two photos?

Rule of Sum:

$$\begin{aligned} & \#(\text{jungle and desert}) + \#(\text{jungle and aquatic}) + \#(\text{desert and aquatic}) \\ = & \quad 4 \cdot 6 \quad + \quad 4 \cdot 5 \quad + \quad 6 \cdot 5 \\ = & \quad 24 \quad + \quad 20 \quad + \quad 30 = \boxed{74 \text{ ways}} \end{aligned}$$