COPYING *Flash Cards for the Book:* *“Representations and Characters of Groups” by Gordon James and Martin Liebeck* REPRESENTATION THEORY	DEFINITION *group* REPRESENTATION THEORY
DEFINITION *subgroup* REPRESENTATION THEORY	DEFINITION *dihedral group* D_{2n} REPRESENTATION THEORY
DEFINITION *cyclic group* C_n REPRESENTATION THEORY	DEFINITION *quaternion group* Q_8 REPRESENTATION THEORY
DEFINITION *alternating group* A_n REPRESENTATION THEORY	DEFINITION *direct product* REPRESENTATION THEORY
REPRESENTATION THEORY	REPRESENTATION THEORY

A **group** consists of a set G, together with a rule for combining any two elements $g, h \in G$ to form another element of G satisfying:

1. $\forall g, h, k \in G, (gh)k = g(hk)$
2. $\exists e \in G$ such that $\forall g \in G, eg = ge = g$
3. $\forall g \in G, \exists g^{-1} \in G$ such that $gg^{-1} = g^{-1}g = e$

$$D_{2n} = \left\langle a, b \,:\, a^n = 1, b^2 = 1, b^{-1}ab = a^{-1} \right\rangle$$

Let G be a group. A subset H of G is a **subgroup** if H is itself a group under the operation inherited from G.

$$H \leqslant G$$

$$Q_8 = \left\langle a, b \,:\, a^4 = 1, a^2 = b^2, b^{-1}ab = a^{-1} \right\rangle$$

$$C_n = \left\{1, a, a^2, \ldots, a^{n-1}\right\}$$
$$C_n = \langle a \,:\, a^n = 1 \rangle$$

Let G and H be groups, consider

$$G \times H = \{(g, h) \,:\, g \in G \text{ and } h \in H\}.$$

Define a product operation on $G \times H$ by

$$(g, h)(g', h') = (gg', hh').$$

The group $G \times H$ is called the **direct product** of G and H.

$$A_n = \{g \in S_n : g \text{ is an even permutation}\}$$

Recall that every permutation $g \in S_n$ can be expressed as a product of transpositions. An **even** permutation has an even number of transpositions, and an **odd** permutation has an odd number of transpositions.

Representation Theory

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