Math 542-Modern Algebra II

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Ok

Febuary 7, 2014

Solution:

$$\mathbb{Z}_{144}$$

$$\mathbb{Z}_{72} \times \mathbb{Z}_2$$

$$\mathbb{Z}_{36} \times \mathbb{Z}_2 \times \mathbb{Z}_2$$

$$\mathbb{Z}_{36} \times \mathbb{Z}_4$$

$$\mathbb{Z}_{18} \times \mathbb{Z}_2 \times \mathbb{Z}_2 \times \mathbb{Z}_2$$

$$\mathbb{Z}_{48} \times \mathbb{Z}_3$$

$$\mathbb{Z}_{24} \times \mathbb{Z}_6$$

$$\mathbb{Z}_{12} \times \mathbb{Z}_{12}$$

$$\mathbb{Z}_{12} \times \mathbb{Z}_6 \times \mathbb{Z}_2$$

$$\mathbb{Z}_6 \times \mathbb{Z}_6 \times \mathbb{Z}_2 \times \mathbb{Z}_2$$

ok

Homework 4

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February 1, 2014

Problem 5 : How many abelian groups of order 144 are there up to isomorphism? Explain.

Problem 5 solution : First according to the theorem, since $144 = 2^4 \cdot 3^2$ We can conclude that :

$$G \simeq G_1 \times G_2$$

Where $|G_1| = 2^4$ and $|G_2| = 3^2$.
Since any finite p-groups is isomorphic to a product of cyclic groups each of which has prime order of p. So we can get all the possible possibilities of G_1 and G_2

$$\begin{array}{ll} G_1 \simeq C_{16} & G_1 \simeq C_8 \times C_2 \\ G_1 \simeq C_4 \times C_4 & G_1 \simeq C_4 \times C_2 \times C_2 \\ G_1 \simeq C_2 \times C_2 \times C_2 \times C_2 & \\ G_2 \simeq C_9 & G_2 \simeq C_3 \times C_3 \end{array}$$

Then we can get all ten abelian group of order 144:

1. $G \simeq C_{16} \times C_9$
2. $G \simeq C_{16} \times C_3 \times C_3$
3. $G \simeq C_8 \times C_2 \times C_9$
4. $G \simeq C_8 \times C_2 \times C_3 \times C_3$
5. $G \simeq C_4 \times C_4 \times C_9$
6. $G \simeq C_4 \times C_4 \times C_3 \times C_3$
7. $G \simeq C_4 \times C_2 \times C_2 \times C_9$
8. $G \simeq C_4 \times C_2 \times C_2 \times C_3 \times C_3$
9. $G \simeq C_2 \times C_2 \times C_2 \times C_2 \times C_9$
10. $G \simeq C_2 \times C_2 \times C_2 \times C_2 \times C_3 \times C_3$