Dr.Memarzadeh Group Theory
Deadline: 1400/12/21 23:59

Problem Set 2(50 points)

Question 1 (Herstein 2.9 Q3). *[20 points] Express as the product of disjoint cycles:*
(a) $(1,2,3)(4,5)(1,6,7,8,9)(1,5)$.
(b) $(1,2)(1,2,3)(1,2)$.

Question 2 (Zee I.2 Q1). *[10 points] Show that for 2-cycles* $(1a)(1b)(1a) = (ab)$.

Question 3 (Zee I.2 Q2). *[10 points] Show that* A_n *for* $n \geq 3$ *is generated by 3 -cycles, that is, any element can be written as a product of 3 -cycles.*

Question 4 (Zee I.2 Q 3). *[10 points] Show that* S_n *is isomorphic to a subgroup of* A_{n+2}. *Write down explicitly how* S_3 *is a subgroup of* A_5.

Question 5 (Herstein 2.9 Q1). *[20 points] Let* G *be a group; consider the mappings of* G *into itself,* λ_g, *defined for* $g \in G$ *by* $x\lambda_g = gx$ *for all* $x \in G$. *Prove that* λ_g *is one-to-one and onto, and that* $\lambda_{gh} = \lambda_h \lambda_g$.

Question 6 (Herstein 2.9 Q11). *[20 points] Prove that the smallest subgroup of* S_n *containing* $(1,2)$ *and* $(1,2,\ldots,n)$ *is* S_{n^*} *(In other words, these generate* $S_n \cdot$ *)*

Question 7 (Herstein 2.9 Q19). *[10 points] Let* G *be the group* $\{e,a,b,ab\}$ *of order 4, where* $a^2 = b^2 = e$, $ab = ba$. *Find the permutation representation of* G.

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