Aalto University School of Science
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MS-C1350 Partial differential equations, fall 2020

Pre-lecture assignment for Tue 01 Dec 2020

Please answer YES or NO, unless otherwise stated.

1. Consider the Cauchy problem for the wave equation in the two-dimensional case.
   (a) The domain of dependence consists of points at the initial moment of time that affect the value of a solution at a given point.
   (b) The domain of dependence is a disc in a plane.
   (c) The range of influence consists of points at which the value of a solution is affected by the value of a solution at a given point.
   (d) The range of influence is a cone in the three-dimensional space.

2. The solution of the Cauchy problem for the wave equation in the two-dimensional case at a given point
   (a) depends only on the initial values near the origin.
   (b) depends only on the initial values far away from the origin.
   (c) depends on the initial values in the whole space.
   (d) does not depend on the initial values.

3. Consider the Cauchy problem for the wave equation in the two-dimensional case. A disturbance of the initial data near the origin influences the solution at a point $x \neq 0$
   (a) forever starting at a certain moment of time.
   (b) from the initial moment until a certain moment of time after which it does not have any influence.
   (c) for a short moment of time starting at a certain moment of time.
   (d) forever starting at the initial moment of time.

4. Consider the Cauchy problem for the wave equation in the two-dimensional case.
   (a) If a solution is zero in some point at a given moment of time, then it is zero at every point at the same moment of time.
   (b) If the initial values are positive everywhere, then the solution is positive everywhere.
   (c) Is a solution is zero everywhere at a given moment of time, then it is zero everywhere before that moment of time.
   (d) The nonhomogeneous Cacuhy problem can be solved using Duhamel's principle.

5. Consider a solution $u \in C^2(\Omega_T) \cap C(\overline{\Omega_T})$ to the wave equation in a bounded space-time cylinder Ω_T.

   (a) u cannot attain its maximum in Ω_T.

   (b) u attains its maximum in Ω_T.

   (c) u attains its maximum in $\overline{\Omega_T}$.

   (d) u attains its maximum in $\Omega \times \{t = 0\}$ or in $\partial\Omega \times [0, T]$.