

# 國立交通大學 106 學年度第 1 學期

## 博士班資格考筆試考試試題

土木工程學系 資訊組(己) 科目：巨量資料處理與分析 選考學生數：1 考試時間：60min

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共 1 頁，第 1 頁

1. (20%) In Amsterdam, there is a first 3D printing bridge built from the 3D printing robot, in this bridge, several kinds of sensors are also installed on it, such as accelerators, gyroscope, moisture, pressure, light sensors as well as camera. In this prototype, over 2 Tera data are collected from these sensors. Please describe your opinion for the 3D printing products applied in such area and how machine learning/big data technology can handle such a large stream of data?
2. (20%) For your knowledge, please give at least one example which apply the technology and processes of the big data and artificial intelligence in the infrastructure development such as bridge, road or high building to detect, prevent or even predict the "EARTHQUAKE".
3. (20%) How do you think if the big data collected, aggregated and analysis can detect the water leakage in structure engineering?
4. (20%) Please evaluate the performance to develop solar panel in public infrastructure such as bridge, road, huge building etc., you can analysis in many different kind of views like cost, environment, structure as well as culture.
5. (20%) Is it possible to use big data knowledge to teach computer learn how to simulate or evaluate to decrease the percentage of non-green building material usage, please describe your points of view.

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## 博士班資格考筆試考試試題

土木工程學系 資訊組(己) 科目：電腦輔助土木工程設計與分析 選考學生數：1 考試時間：90min

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共 1 頁，第 1 頁

1. (20%) What are the major roles of the computer in design process?
2. (20%) Determine the form of transformation matrix for a reflection about an arbitrary line with equation  $y = mx + b$ .
3. (30%) There are several approaches for modeling 3D curves in computer graphics, including Hermite curves or Bezier curves.
  - (a) Define these two cubic-curves with the form of  $Q(t) = \mathbf{T}\mathbf{M}\mathbf{G}$ , where  $\mathbf{M}$  is basis matrix and  $\mathbf{G}$  is geometry matrix, respectively.
  - (b) If a hybrid cubic-curve is made via joining with a Hermite curve and a Bezier curve in  $C^1$  continuity at the joint point, what are the necessary conditions for these two cubic splines?
4. (20%) Hidden surface elimination (or visible surface determination) in computer graphics can be performed through z-buffer, scanline z-buffer, scanning scanline, or Warnock's algorithm. Please explain these approaches with pseudocode or procedures.
5. (10%) Consider the function  $E = (x-1)^2$  over the range  $(-6, 10)$ . The minimum ( $E = 0$  and  $x = 1$ ) can be found via **Golden Section Search**. If an accuracy  $\varepsilon = 0.1$  is given, at least how many iterations needs to obtain this minimum? Note that, the golden ratio  $k = 0.6180$ .