

# 國立陽明交通大學 111 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

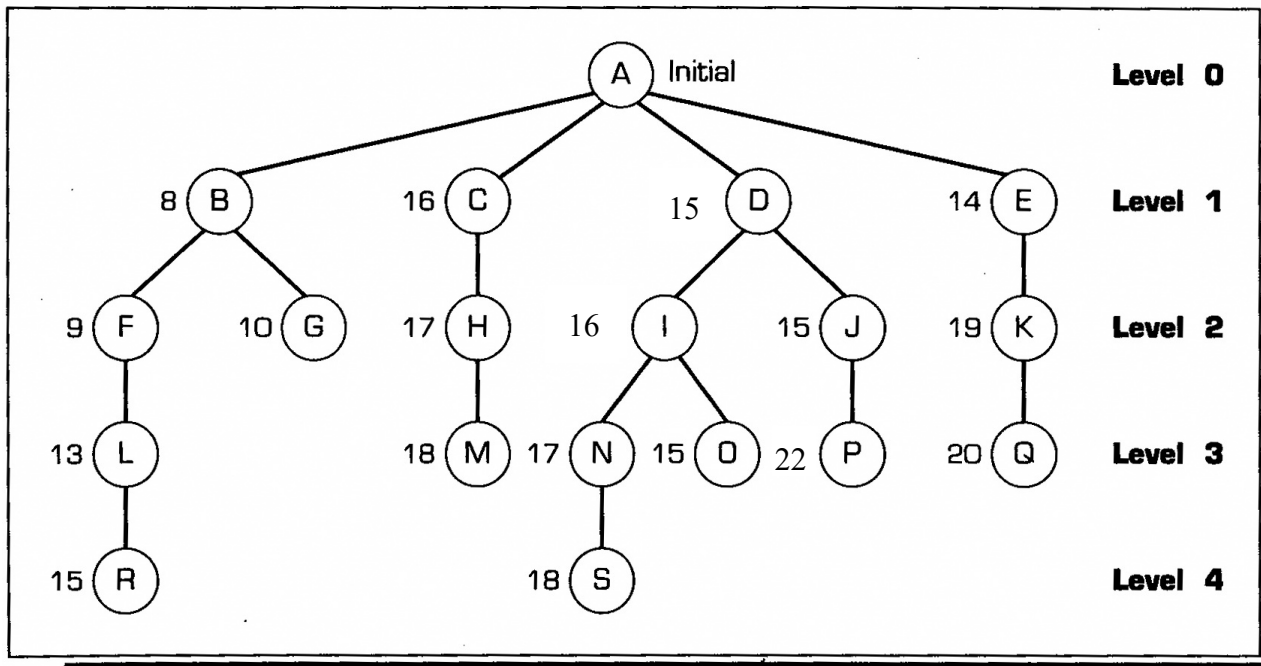
科目：人工智慧在土木工程之應用

選考學生數：1

考試時間：60min

共 2 頁，第 1 頁

1. Study the search tree given here. The numbers above the nodes illustrate the profit associated with a project designated by the specific nodes. The goal is to find a project with a **value of twenty or higher**.
  - (b) Use a depth-first approach to identify the node.
  - (c) Use a hill-climbing approach to identify the node.
  - (d) Use the best-first (A\*) approach to solve the problem.



2. In artificial neural networks (ANN), error back-propagation (BP) is one of important learning models.
  - (a) Please present the flowchart of error back-propagation (BP) learning algorithm.
  - (b) What is the main utility for momentum term in conventional BP algorithm?
  - (c) What is the drawback for the constant learning ratio in BP?
  - (d) Can we normalize the inputs and outputs in the interval of  $[0, 1]$  as the sigmoid function  $1/(1+e^{-x})$  is utilized? Why?
  - (d) Please derive the  $\Delta w_{kj} = -\mu \frac{\partial E(w)}{\partial w_{kj}}$  for weights between output layer and hidden layer. Here, system error is defined as
 
$$E = \frac{1}{2P} \sum_{p=1}^P (d_p - o_p)^2$$
 where  $P$  is number of training instances.  $d_p$  and  $o_p$  are the desired and computed output for the  $p$ th training instance.
3. What is Overfitting in Deep Learning model? Please show three different ways to avoid it.

4. The vanishing gradient problem occurs in deep learning (DL) frequently. What is gradient vanishing problem? How to solve the problem.
5. Convolution neural networks (CNNs) and LSTM are two popular models in DL. Please describe the major utility of these two models and the basic blocks (sub-models) of them.
6. Big data is important for AI applications. Big data is a collection of data from many different sources and is often describe by five characteristics. Please show these five characteristics (5Vs).