國立臺灣科技大學

115學年度碩士班招生

試題

系所組別：5100智慧製造科技研究所碩士班

科　　目：智慧製造概論

<<551001>>

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(總分為100分;所有試題務必於答案卷內頁依序作答)

1. (70%) Multiple-choice Question

(1) (2.8%) If quality prediction uses only final measurements, what is most likely missing?

A. Product Bill of Materials

B. Calibration logs

C. Intermediate-stage process variability

D. Product Bill of Materials

(2) (2.8%) The main advantage of Rolling-Horizon optimization is:

A. Always faster than static optimization

B. Continuously adjusts decisions based on updated system states

C. Requires no model

D. Avoids data requirements

(3) (2.8%) Which of the following statements best describes the impact of increasing forecast error on a production or inventory system?

A. Higher forecast error increases inventory variability because safety stock buffers become unnecessary.

B. Higher forecast error increases the risk of both stockouts and overstock due to greater demand uncertainty.

C. Higher forecast error improves scheduling stability because production plans become more conservative.

D. Higher forecast error has no significant impact as long as average demand remains constant.

(4) (2.8%) Which of the following statements is FALSE regarding the use of robots for material handling in a warehouse or manufacturing system?

A. Robots can provide consistent and repeatable handling accuracy with reduced human error.

B. Robots can operate for long hours without fatigue, enabling continuous operation.

C. Robots can improve safety by reducing human exposure to heavy or dangerous tasks.

D. Adding more robots will always improve the warehouse's efficiency.

(5) (2.8%) Which of the following statements about applying Big Data and Machine Learning (ML) in smart manufacturing is TRUE?

A. ML models trained on highly aggregated data often miss important variability patterns needed for accurate predictions.

B. Big Data analytics becomes unnecessary when the production process is mostly automated.

C. ML models automatically perform well as long as the volume of collected data is large.

D. Adding more sensor features generally eliminates the need for feature engineering.

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(6) (2.8%) Which of the following techniques is used for matrix operations?

A. Linear Programming

B. Dynamic Programming

C. Linear Algebra

D. Integer Programming

(7) (2.8%) Which of the following is the most commonly used automation language/system?

A. Python

B. C++

C. PLC

D. LISP

(8) (2.8%) In multithreading, the mechanism used to prevent two programs (threads) from interlocking is:

A. Linked List

B. Multi-dimensional

C. IRQ

D. Mutex

(9) (2.8%) Which scientist proposed the "Imitation Game" to judge whether a machine possesses intelligence?

A. Newton

B. Einstein

C. Turing

D. Von Braun

(10) (2.8%) In computer programming/architecture, the signal that triggers the hardware to execute a specific program (handler) is called:

A. IRQ

B. CRQ

C. FRQ

D. DRQ

(11) (2.8%) Which description of Cloud computing service models is correct?

A. IaaS provides virtualized computing resources such as servers, storage, and networking

B. PaaS offers a platform for application development without managing the underlying infrastructure

C. SaaS allows users to develop and deploy applications directly on virtual machines

D. All the above are correct

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(12) (2.8%) In cloud computing deployment, which model is exclusive to one organization?

A. Public cloud

B. Private cloud

C. Hybrid cloud

D. Community cloud

(13) (2.8%) Which description of 6LoWPAN is incorrect?

A. It improves energy efficiency for small wireless sensor nodes

B. It's a high-speed networking standard

C. A protocol that enables IPv6 over low-power wireless personal area networks

D. It is designed for constrained devices in IoT applications

(14) (2.8%) What is the main objective of the inverse kinematics problem in robotics?

A. To compute motor torques for a given motion

B. To determine joint variables for a desired end-effector pose

C. To design the shape of robot links

D. To calculate the robot's workspace volume

(15) (2.8%) Which of the following statements about velocity and workspace is true?

A. At singular configurations, the end-effector can achieve infinite velocity for specific directions of motion.

B. Inside the dexterous workspace, the Jacobian rank is less than full, limiting motion directions.

C. On the boundary workspace, the determinant of J is maximal, leading to the highest velocity amplification.

D. The reachable workspace is defined by all points where the end-effector velocity is zero.

(16) (2.8%) What best explains the vanishing gradient problem?

A. Large learning rates cause unstable updates

B. Gradients shrink exponentially as they propagate backward through many layers

C. Loss functions become non-differentiable

D. Weight initialization is random

(17) (2.8%) The Forget Gate in LSTM controls:

A. The quantity of new information stored

B. The proportion of previous memory retained

C. Output scaling

D. Learning rate adjustment

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(總分為100分;所有試題務必於答案卷內頁依序作答)

(18) (2.8%) Why is cGAN preferred in industrial defect synthesis?

A. It generates faster

B. Samples are conditioned on defect categories

C. Annotation is not required

D. It replaces object detectors

(19) (2.8%) The main concept behind Knowledge Distillation is:

A. Feature alignment

B. Transferring probability distributions from teacher to student networks

C. Removing redundant parameters

D. Model quantization

(20) (2.8%) What is the biggest advantage of a two-stage detection pipeline (classification → detection)?

A. Improved precision

B. Reduced annotation effort

C. Significant reduction in inference cost

D. Easier training

(21) (2.8%) Which of the following algorithms falls under the category of "Supervised Learning"?

A. K-Means Clustering

B. Principal Component Analysis (PCA)

C. Support Vector Machine (SVM)

D. Apriori Algorithm

(22) (2.8%) What is the primary purpose of applying feature scaling techniques, such as Normalization or Standardization?

A. To create interaction terms between different variables to capture complex patterns.

B. To prevent features with large magnitudes from dominating the objective function.

C. To impute missing values using statistical methods like the mean or median.

D. To transform categorical variables into a numerical format like one-hot encoding.

(23) (2.8%) Why is it necessary to introduce non-linear activation functions (such as ReLU or Sigmoid) in a deep neural network?

A. To initialize the weights of the network.

B. To normalize the input data batch by batch.

C. To allow the network to approximate complex non-linear functions.

D. To prevent the gradients from exploding.

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(24) (2.8%) Which neural network architecture is specifically designed to handle sequential data, such as time series analysis or natural language processing?

A. Convolutional Neural Network (CNN)

B. Recurrent Neural Network (RNN)

C. Generative Adversarial Network (GAN)

D. Autoencoder

(25) (2.8%) According to the Bias-Variance Tradeoff, a highly complex model (such as a deep network with many parameters) without proper regularization tends to exhibit:

A. High Bias and Low Variance.

B. Low Bias and High Variance.

C. High Bias and High Variance.

D. Low Bias and Low Variance.

2. (15%) In a smart factory, inconsistencies between data flow and control flow often cause scheduling errors and inaccurate bottleneck detection. Analyze the issue from the following perspectives:

   (1) (7.5%) Update-frequency mismatch between the physical system and the Digital Twin.

   (2) (7.5%) Uncalibrated processing-time variability models.

3. (15%) During the 11/11 shopping festival, many customers experience delivery delays. An investigation shows that the extremely high order volume has exceeded the processing capacity of the warehouse. The facility already operates an automated storage system in which robots are responsible for moving storage units, while human workers perform the picking tasks. Given this situation, propose smart-manufacturing or data-driven methods that can improve warehouse efficiency during peak-demand periods. Your answer should focus on intelligent, algorithm-based, or analytics-driven solutions rather than increasing manpower or expanding physical capacity. Listing methods without specifying their application will receive no credit.