

FACULTY OF SCIENCE

ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MODULE	IT28X07 BIOMETRICS
CAMPUS	AUCKLAND PARK CAMPUS (APK)
EXAM	JUNE 2019

DATE: 2019-06-04

SESSION: 08:30 - 10:30

ASSESOR(S):

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EXTERNAL MODERATOR:

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DURATION: 120 MINUTES

MARKS: 100

Please read the following instructions carefully:

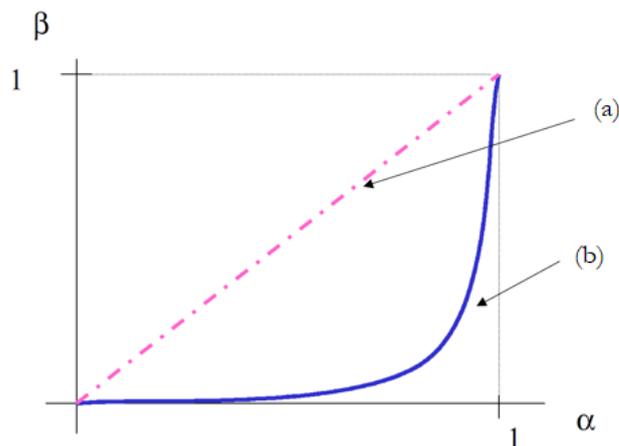
1. Answer **all** the questions
 2. Write *cleanly* and *legibly*.
 3. You may use a non-programmable calculator to answer the questions.
 4. This paper consists of 4 pages.
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SECTION A - SHORT QUESTIONS

QUESTION 1

General Biometric Systems

- (a) Name four (4) **requirements** Jain says a biometric needs to satisfy for it to be used for identification in his article entitled "An Identity Authentication System Using Fingerprints". (4)
- (b) Analyse the following image and answer the questions that follow: (6)



1. What does the above overall image depict? (2)
2. What does α depict? (1)
3. What does β depict? (1)
4. Label (a) and (b). (2)

Total: 10

QUESTION 2

- (a) List the four (4) **requirements** needed to capture a hand geometry sample. (4)
- (b) Illustrate with the aid of a diagram the following types of minutia: (4)
1. Delta
 2. Ridge split
 3. Lake
 4. Whorl

Total: 8

QUESTION 3*Face Recognition*

- (a) Analyse the equation below and describe which method the following equation relates to: (2)

$$G_c[i, j] = B e^{-\frac{(i^2 + j^2)}{2\sigma^2}} \cos(2\pi f(i \cos\theta + j \sin\theta))$$

- (b) A key part of the face recognition process is face detection. List four (4) **face detection class types** that each face detection algorithm can be classified into. (4)
- (c) Name two (2) examples of publicly available face **datasets**. (2)

Total: 8

QUESTION 4

- (a) Briefly describe three (3) limitations of **speaker recognition**. (3)
- (b) **Name** and **describe** two (2) methods for **converting** an audio signal from the time to frequency domain. (4)

Total: 7

QUESTION 5

Conjunctiva recognition-based biometric systems is a new biometric technologies being developed today. Discuss the **process** required to capture a conjunctiva, along with the **steps** required to process and match a conjunctiva sample. For each step in your discussion be sure to elaborate on the following aspects:

- The sensor that can be used to capture a sample.
- A brief description of the steps followed to process and match a sample.
- The algorithms used at each step.

Total: 8

QUESTION 6*Behavioural Biometrics*

- (a) List four (4) features for the **dynamic** product that can be used in signature recognition system. (4)
- (b) Name two (2) examples of **features** used in keystroke dynamics systems. (2)
- (c) Briefly describe the **semiotic** type of gesture. (2)

Total: 8

QUESTION 7

Palm, Multi-modal and Pervasive Systems

- (a) List two (2) **types of features** in palmprint recognitions systems **NOT** found in traditional fingerprint systems. (2)
- (b) List the three (3) **types of biometric fusion**. (3)
- (c) Define human **biopotential** and provide one (1) example. (3)

Total: 8

QUESTION 8

Biometric Trends and Esoteric Biometrics

- (a) Discuss **facial thermography**, along with an advantage and disadvantage of the technology. (4)
- (b) One intriguing esoteric biometric is **brain waves**. Discuss how a biometric system that uses brain waves **works**, along with its **advantages** and **disadvantages**. (4)

Total: 8

QUESTION 9

Vulnerabilities and Countermeasures

Draw an **attack tree** that highlights the **weaknesses** that will typically be found for a **mobile phone-based iris recognition access control** system such as the one found in the Samsung S8 **AND** provide a discussion on two **reasons** why you would want to subvert a biometric system, **ALONG** with two ways to **safeguard** against them.

Total: 10

SECTION B - LONG QUESTIONS

QUESTION 10

A new analytics company that specialising in derived insights in social media is providing a specific product for political parties. The product allows them to gauge the sentiment on specific topics for each of their constituent categories and influence certain segments within those categories. The Electoral Commission of South Africa has approached you to determine the ethical and legal implications of this new “grey area”. Discuss these statements by paying special attention to the following:

- The common criticisms of behavioural biometrics.
- The ethical considerations related to biometrics.
- The legal aspects related to biometrics and whether they should be able to sell this product.

Total: 10

QUESTION 11

The South African Home Affairs is in charge of providing identity documents for citizens, along with residents, which currently amounts to almost 58 million people and they are currently looking at different ways to improve the current passport. One suggestion is to integrate biometric technology into it, but there are concerns on whether this would be a good idea or not and they need clarity on how to evaluate these types of systems. Comprehensively discuss **large-scale** biometric systems, **biometric evaluation**, and the **biometric technology** you would select by paying special attention to the following:

- The considerations one should make when deploying large-scale biometric systems.
- The metrics that should be used to evaluate biometric systems.
- Advantages and disadvantages of your selected biometric technology.
- Your opinion on whether they should integrate biometric technology in passports.

Total: 15

— End of paper —