Vrije Universiteit, Faculteit Exacte Wetenschappen,
Afdeling Informatica

Model tentamen voor **Pervasive Computing 2008**

Uitwerkingen

Dit is een gesloten boek schriftelijk tentamen.
Tijdens het tentamen mogen geen schriftelijke of elektronische artikelen worden geraadpleegd.
De antwoorden kunnen in het Nederland of Engels gegeven worden.

Minimaal 5.5 voor het huiswerk is vereist voor het deelnemen aan het tentamen.
Minimaal 5.5 voor het tentamen is vereist voor een voldoende voor het hele vak.
Er zijn 6 tentamenvragen, Q1..Q6 en de som ervan is maximum 90p.
Het tentamencijfer wordt berekend als: (Q1+Q2+…Q6+10)/100
Het eindcijfer is berekend als 0.3*huiswerk + 0.7*tentamen.
Een eindcijfer >=5.5 betekent een voldoende voor dit vak.

	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**ΣQi**	**Maximum = (ΣQi+10)/10**
a)	**2**	**5**	**3**	**3**	**4**	**4**		
b)	**3**	**3**	**3**	**3**	**3**	**4**		
c)	**3**	**3**	**3**	**4**	**3**			
d)		**5**	**3**					
e)		**5**	**3**					
f)		**3**	**5**					
i)			**5**					
j)			**5**					
Totaal	**8**	**24**	**30**	**10**	**10**	**8**	**90**	**10**

1. Pervasive Computing Algemeen [8p]

a) Wat is een context-aware application? [2p]
b) Noem de 3 principes van pervasive computing volgens de Marc Weiser visie. [3p]
c) Deze vraag gaat over de specifieke artikelen van huiswerk HW1 die jullie groep gelezen heeft. Voor een van de twee projecten beschrijf een eigenschap die volgens jullie de applicatie pervasive maakt. [3p]

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a) Context is any information about situations or circumstances where a computing takes place (location, emotional state, time, current user action, etc). A context aware application detects (senses) such a context and makes use of this information, for example to assist or augment a person.
b) 1. every computer is linked with a network
2. users do not have to be aware of this linking process
3. through human friendly interfaces situation appropriate services are provided on the network at the right time

2. Computer systemen [24p]

a) Schrijf de volgende getallen in tweetalig (binair) en 16-tallig (hexadecimaal) stelsel: 65, 102, 255, 1024.[5p]
b) Wat is een parity bit? Geef een voorbeeld. [3p]
c) Hoeveel adreslijnen zijn nodig voor een 1-byte brede 16 Mbyte geheugen? [3p]
d) Noem de belangrijke componenten van een CPU. Laat stapwijs zien wat gebeurt in een CPU bij uitvoering van de instructie 2 3 + = [5 p]
e) Noem de belangrijke componenten van een harddisk en leg uit hoe wordt de informatie ervan gelezen [5p].
f) Noem en beschrijf de 2 rollen van een besturingsysteem als proces administrator [3p]

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a). 65: 1000001 in binair 41 in hexadecimaal
102: 1100110 in bin; 66 in hex
255: 11111111 in bin: FF in hex
1024: 10000000000 in bin; 400 in hex

b)A parity bit is the simplest error detecting code. It is a bit added by the sender to the transmitted message in order to enable a check on the correctness of the transmission. There are 2 types of parity bits: even and uneven. For even parity the added bit ensures that the sum of all 1 bits in the message is even.

For example if this string has to be sent:
01000001 (has an even nr. of 1s)
Then in case of an odd parity, the parity bit added has to be an 1, so that the total pattern has an odd nr. of 1's.
The receiver can calculate the sum of the total pattern 1's and detect a possible transmission error.

c) Any 1 byte location has to be accessed.
1 MByte memory means 2^20 bytes. 16 Mbytes memory means 16x2^20 = 2^4x2^20 = 2^24. So we need 24 address lines in order to access 2^24 bytes.

d) The main components of a CPU (from Morley's book p. 81) : Arithmetic/Logic Unit (ALU) a floating point (FPU), Control unit. Prefetch unit. Decode Unit. Internal Cache and registers, Bus interface unit. What happens when 2+3 command is processed has to be described in 4 steps, like in the book at page 85. Or like the Intel museum tour demo used during the lecture shows.

e) From Morley's book. P. 107) A hard disk drive has a stack of hard disks, read/write heads and a mounting shaft and a sealed drive. Each side of the hard disk can be read. So for example a 4 hard disk drive has 8 possible recording surfaces. In addition to tracks, sectors and clusters a hard disk also uses cylinders to track where the data is stored. A cylinder is a vertical stack of tracks, the same relative track on each disk surface.
The mounting shaft spins the disks at a speed of x thousand revolutions per minute. To read or write data hard drives have one read/write head for each surface. The heads are mounted on the access mechanism. All the heads move together all the tracks in the cylinder are accessed in the same time.

f) A process administrator has 2 roles: (1) scheduler – adds new processes to the process table and removes completed processes from the process table. and (2) dispatcher – controls the allocation of time slices top the processes in the process table.

2. Computernetwerken [30p]

a) Wat is het verschil tussen een circuit switched and packet switched netwerk.[3p]
b) Hoe groot is de transmission delay voor een pakket van 500 bits door een 10 Mbps Ethernet link? [3p]
c) Wat is het belangrijke verschil tussen tier-1 ISP en tier-2 ISP ? [3p]
d) Hoe wordt een hostnaam naar een IP adres vertaald? En hoe wordt een MAC-adres bepaald, uitgaande van een IP-adres? [3p]
e) Wat is de rol van de network layer? [3p]
f) Hoe werkt de CDIR adressering in Internet? [5p]
g) Wat zijn sequence number and ackowlegdement number in de TCP protocol and wat is hun rol? [5p]
h) Leg uit hoe CSMA/CD protocol werkt.[5p]

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a) In circuit switched networks all data between node A and B takes the same path (dedicated path).
In packet switched networks data is sent as individual packets, following different paths and assembled at the destination.

b) Assuming a first come-first served manner used in packet switched networks, the transmission delay is L/R, where L is the length of the packet [bits] and R is the transmission rate [bits/sec]. dtrans = 50 µs.

c) tier-1 ISP are directly connected to each other tier-1 ISPs. They have extremely high transmission rates. And they don’t have to pay.

d) Internet uses for the translation hostnames to IP addresses a domain name system (DNS). DNS is a distributed database and a application layer protocol that allows hosts to query this database.
Internet uses for the translation between an IP address and a MAC address the Address Resolution Protocol (ARP). Each node (host or router) has in its RAM an ARP table which contains mappings of IP addresses to MAC addresses.

e) The network layer implements the host-to-host communication service. It has 2 functions: 1) forwarding, i.e. moves packets from router’s input to appropriate

router output and 2) routing: determines route taken by packets from source to destination.

f) CIDR is the Internet address assignment strategy. Classless Interdomain Routing. An 32-bit IP address id divided into 2 parts like a.b.c.d/x, where x indicates the number of bits in the first part of the address. The first x bits represent the prefix of the address (subnet). Usually IP addresses of devices within an organization share the common prefix.

g) The sequence number (seq) and acknowledgement number (ack)are fields in the TCP segment header. They are used by the sender and receiver in implementing a reliable data transfer service.

Seq for a segment is the byte-stream number of the first byte in the segment.
Suppose host A received a segment from host B. The acknowledgement number (acq) that host A puts in its acknowledgement segment to B is the sequence nr. of the next byte host A is expecting from host B. For example is ack is 42 it means that host A received everything up through byte 42 and is waiting for byte 43.
Using the sequence numbers the receiver can merge different received segments to reassembly them again in good order in a message and sends it to higher network layers.
The acknowledgement number can be used by the sender to be sure that all bytes until that number have been received properly.

h) CSMA/CD is a multiple access control (MAC) protocol used by Ethernet. It means carrier sensing multiple access /collision detection. A network card (NIC) creates a frame and senses the channel. If channel is idle, it starts frame transmission. If frame can be sent without collisions, NIC is ready with the frame. If collision is detected during sending the frame, transmisison is aborted and a jam signal is sent. After aborting, NIC waits a random time by entering a so-called exponential backoff. Until the channel is again idle.

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3. Sensoren [10p]

a) Noem een oplossing die gebruikt wordt voor een goede energiemanagement in WSN.[3p]
b) What is Smart Dust? [3p]
c) Noem 3 sensoren uit Lego Mindstorms en 2 fysiologische sensoren en leg uit wat ze precies meten. [4p]

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a) most of the time a sensor has nothing to do. So it can go to sleep. Graded sleep state model with multiple states of operation with reduced energy consumption.
b) Smart Dust: is the term used to describe a network of tiny wireless sensors, robots, or devices, installed with wireless communications, that can detect for example light, temperature, or vibration. The most well-known implementation is the Smart Dust Project at Berkeley University of California. The goal of this project is to demonstrate that a complete sensor/communication system can be integrated into a cubic millimeter package.
c) Here more answers are possible. Ultrasound: measures the distance to an object by sending a sound and measuring the round trip time. Microphone: measures the ambient sound level. Light sensor. Sends a light beam and measures the reflected light or measures the ambient light.
   Finapress measures the oxygen level in blood, Galvanic skin response: measures the resistance between 2 point on the skin when a small electrical current is applied to the body.

4. Localizatie [10p]

a) Wat is GPS? Welke parameters krijgt een user van de GPS? [4p]
b) Leg uit hoe iterative multilateration techniek werkt. [3p]
c) Wat is en hoe werkt een Active Badge? [3p]

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a) GPS (Global Positioning System) is a constellation of 24 satellites that provide navigation data to military and civilian users all over the world. The data a user (GPS receiver) can obtain from a GPS are 3 user coordinates (longitude, latitude, height) and the universal coordinated time (UTC).
b) Iterative multilateration is a multi-hop localization method in a WSN. Suppose nodes A,B,C are not aware of their location. But node A can perform triangulation to 3 anchors and find its location. Than A becomes an anchor and helps node B to find its location, etc. A drawing can explain even better the method.
c) (Weiser in HW1 talks about them, but there is also a slide in location lecture). An Active badge (Olivetti) was the first system built to locate simple badges in a building. The badges identify themselves to receivers placed through the building making possible to keep track of people. Uses proximity detection with infrared.

5. Privacy en security [8p]

a) Hoe kan de locatie privacy van de gebruiker geschonden worden op ieder netwerk laag? [4p]

b) Beschrijf 4 mogelijke beveiligingsproblemen in een RFID systeem.[4p]

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a) application layer: login tracking. Network layer: DNS and traceroute info. Link layer: Correlating MAC addresses. Physical layer: Signal triangulation.

b) More answers are here possible.
For example: (1) sniffing : unauthorized readers cab scan tagged items.

(2) spoofing: attackers can create authentic tags by writing appropriately formatted data on blanck tags (cloning).
(3) replay attacks. Attacker records the encrypted identifier and replays it back by abuse.
(4) Denial of service. Thief removes tags from items, or temporarily deactivates them.