SUMMER – 2019 EXAMINATION
MODEL ANSWER

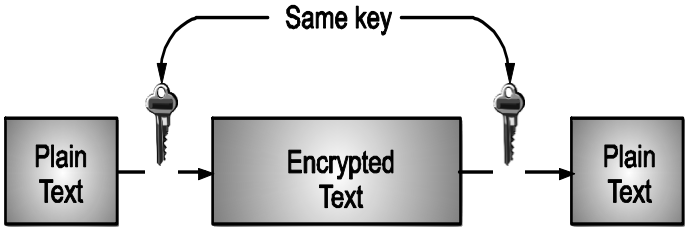
Subject: Mobile Computing **Subject Code: 17632**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
1.	**(A)**	**Attempt any THREE of the following:**	**12**
	(a)	**Enlist any four mobile computing devices.**	**4M**
	Ans.	**Mobile computing devices are:** 1. Laptop (notebook computer or notepad) 2. Mobile phone 3. Personal Digital Assistant 4. Pager/Beeper 5. Sensor and Embedded Controller 6. GPS Navigation device	***Any 4 devices 1M each***
	(b)	**State and explain the services provided by GSM.**	**4M**
	Ans.	In GSM terminology, telecommunication services are divided into three broad categories: **List of GSM Service:** 1. Bearer services 2. Tele services 3. Supplementary Services	***List 1M***

		Bearer services are also called as Data services. These are telecommunication services providing the capability of transmission of signals between access points [the user-network interfaces (UNIs) in ISDN]. For instance, synchronous dedicated packet data access is a bearer service. **Teleservices are telecommunication services** providing the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between network operators. **Supplementary Services**. In addition to these services, supplementary services are defined that modify or supplement a basic telecommunication service. Supplementary services include several forms of call forward (such as call forwarding when the mobile subscriber is unreachable by the network), caller identification, call waiting, multiparty conversations, charging information, and call barring of outgoing or incoming calls. These call-barring features can be used for example when roaming in another country, if the user wants to limit the communication fees.	***Explanation 3M***
	(c) Ans.	**Name the mobility databases and explain their functions.** **The home location register (HLR) is database** used for mobile user information management. All the permanent subscriber data are stored in this database other than a secret key. An HLR record consists of three types of information. **1. Mobile station information:** It stores IMSI (International Mobile Subscriber Identity) used by mobile station to access the network and the MSISDN (Mobile Station - ISDN) which is ISDN number - the "phone number" of cm MS. **2. Location information:** It stores the ISDN number (address) of the VLR where the MS resides and the ISDN number of the MSC where the MS resides. **3.Service Information:** It stores the information such as service subscription, service restriction and supplementary services.	**4M** ***Name 1M***

		The visitor location register (VLR) is a database which consists of information about service area visited by the MS. The VLR contains all the data which is needed by the MS for call handling and other purposes. Similar to HLR, the VLR information also consists three types of information. **1. Mobile station information:** It stores information such as IMSI, MSISDN and TMSI (temporary mobile subscriber identity) as defined in GSM. **2. Location information:** It stores information such as MSC number and the location area Id (LAI). **3. Service information:** Service information which is a subset of service information stored in the HLR. In the MS related fields, TMSI, structure can be determined by each operator, but the length is eight digit. LAI consists of 3 digit mobile country code (MCC), two or three digit mobile network code, and location access code of 16 digits.	***Explanations of function s 1M each***
	(d) Ans.	**Describe symmetric key cryptography.** An encryption system in which the sender and receiver of a message share a single, common key that is used to encrypt and decrypt the message. The most popular symmetric-key system is the Data Encryption Standard (DES).  Symmetric key cryptography The Key components of symmetric key Cryptography (Optional) **1. Plaintext:** The original data or text is called plaintext. **2. Ciphertext:** The original message changed to another unreadable format using some algorithm is called Ciphertext.	**4M** ***Diagram 2M***

		3. Key: Key is a number on which algorithm is based, like the Caesar cipher uses key no 3. **4. Encryption algorithm:** This algorithm is required at sender's side for changing the original message (Plaintext) to unreadable format (Ciphertext) to protect the data from other non- valid receivers. **5. Decryption algorithm:** Required at receiver's side for retrieving the original message that is to change the ciphertext to plaintext. **6. Hashed message Authentication code:** In this case the copy of the key is added along with data and combination is hashed using the key less hash function such as SHA 1.Result of this Is HMAC which is then again prep ended with that same key and result is again hashed using that algorithm. At receiver side the receiver creates its own HMAC and compares it with delivered to validate and check for authentication. **7. Digital signature**: Like in case of banks when user signs a cheque, they check your signature for authentication to see that the user is valid. To understand the concept of Digital signature, let us take an example there are two users A and B.A send message to B and B checks that the message came from A not anyone else. B can ask A to sign the message so that it can be proved that A is the actual sender and B verifies the authenticity. This is known as digital signature. For implementing cryptography we need encryption algorithm for changing plaintext to ciphertext and decryption algorithm at receiver's side for changing Ciphertext to plaintext.	***Description 2M***
1.	**(B)** **(a)** **Ans.**	**Attempt any ONE of the following:** **Explain VLR failure restoration procedure.** **VLR Failure Restoration:** After VLR failure, 1) The service information of VLR record is recovered by first contact between the VLR and the HLR of the corresponding MS. 2) The location information is recovered by the first contact between the VLR and the MS. 3)The mobile station information is recovered either from HLR or MS. VLR restoration procedure is initiated by one of the following three events. 1. MS registration	**6** **6M** ***VLR failure 3M***

2. MS call origination
3. MS call termination

1. MS registration:

Since the record in the VLR get erased due to the failure, then the normal registration procedure define in inter-VLR movement is applied to recovered the VLR record. In this case, TMS1sends from the MS to the VLR that is not recognised, and MS asked to send IMSI over the air.

Each event 1M each

2. MS call origination:

When VLR receives the call origination request MAP_SEND_INFO_FOR_OUTGOING_CALL from the MSC, then the VLR record for the MS is not found. VLR considers this situation as a system error, with cause "unidentified subscriber". Request is then rejected and MS indicate the location registration procedure, then the VLR record is recovered.

3. MS call termination:

The call termination message flow is illustrated in Fig.

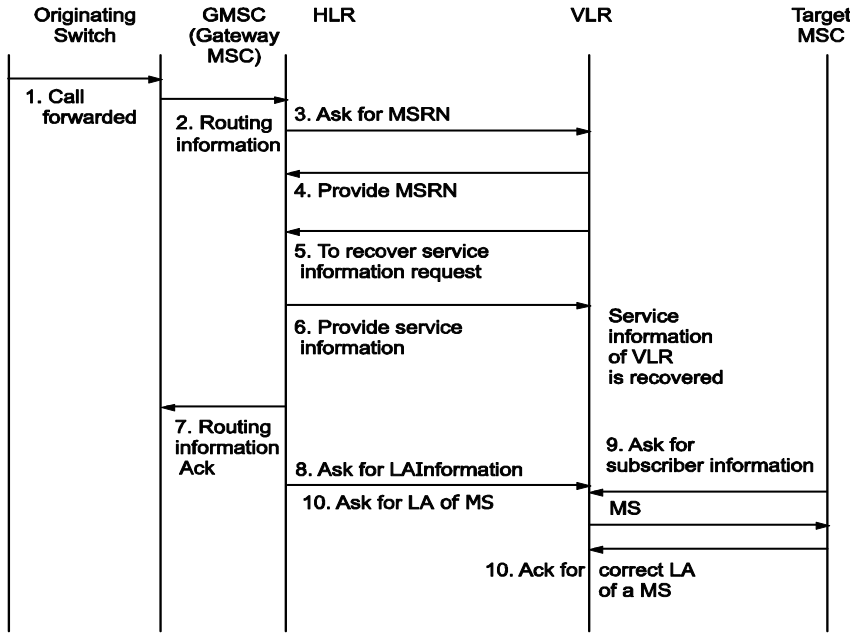


Fig. VLR failure restoration

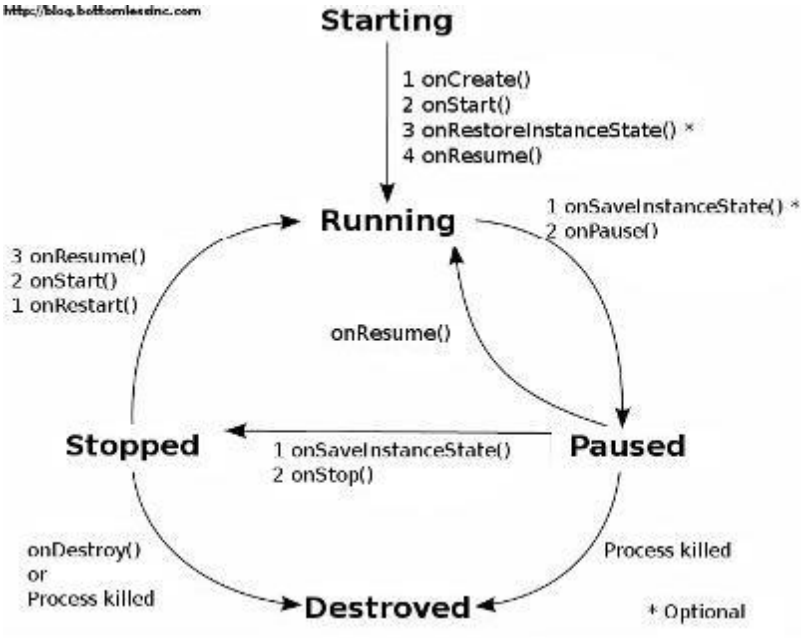
Step 1: When the MS ISDN is dialed the call is forwarded to GMSC (Gateway Mobile Switching Centre), GMSC is a switch which ask the HLR for routing information. The HLR request to VLR of

		the MS to provide the routing address for the MSRN (Mobile Station Roaming Number). **Step 2:** The VLR returns the MSRN to the GMSC through the HLR. **Step 3:** The GMC uses the MSRN to route the call to the MS through the visited MSC (Mobile Switching Centre). [Note that the IMSI - (International Mobile Subscriber Identity) and the MSC number are provided in the message which is send from HLR to VLR]. Then the VLR searches MS record, but the record is erased due to the failure because of this the search PS fails the VLR creates a new VLR record for the MS. Neither the service nor the location information is available in this record. Steps 4 and 5 are executed parallelly. **Step 4 and 5 :** VLR does not have routing information; it uses MSC number to create MSRN. The number is sent back to gateway MSC to set up the call in Step 8. **Step 6 and 7:** The VLR recovers service information by sending MAP_RESTORE_DATA message to HLR. Then HLR sends service information to VLR by using MAP_INSERT_SUBSCRIBER_DATA message. At this point service information of VLR record has been recovered. Still the location information specifically the LAI number, still not available. **Step 8:** After gateway MSC receive the MSRN in Step 7, the target MSC does not have LA information of the MS. In order to proceed to set up the call and asked for LAI information. Unfortunately VLR does not have LAI information. Hence, VLR ask MSC to determine the LA of MS by sending MAP_SEARCH_ FOR_MOBILE_SUBSCRIBER message. **Step 9:** The MSC initiate paging of MS in all LAS. If the paging is successful, the current LA address of MS is sent back to VLR. At this point LA information of VLR record is recovered.	
	(b) Ans.	**With neat diagram, describe the life cycle of android activity.** As an activity transitions from state to state, it is notified of the change by calls to the following protected methods:	**6M**

			Description 2M

onCreate()	This is the first callback and called when the activity is first created.
onStart()	This callback is called when the activity becomes visible to the user.
onResume()	This is called when the user starts interacting with the application.
onPause()	The paused activity does not receive user input and cannot execute any code and called when the current activity is being paused and the previous activity is being resumed.
onStop()	This callback is called when the activity is no longer visible.
onDestroy()	This callback is called before the activity is destroyed by the system.
onRestart()	This callback is called when the activity restarts after stopping it.

Taken together, these seven methods define the entire lifecycle of an activity.



Android Activity Life Cycle

Diagram 4M

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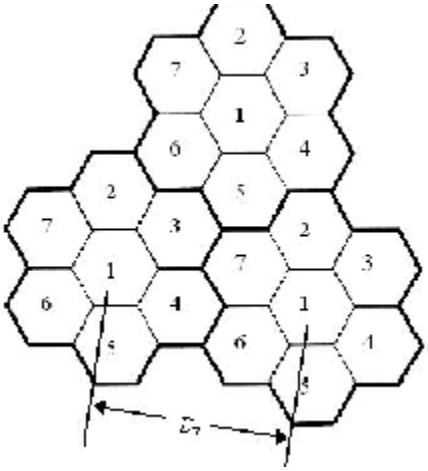
2.		**Attempt any FOUR of the following:**	**16**
	(a)	**Define mobile computing. List and explain various mobile computing functions.**	**4M**
	Ans.	**Definition of mobile computing:** In other words, mobile computing is a term used to describe technology that enable people to access network services any place, anytime and anywhere. "People and their machine should be able to access information and communicate with each other easily and securely, in any medium or combination of media - voice, data, image, video or multimedia - anytime, anywhere, in a cost effective way".	***Definition 1M***
		Mobile Computing Functions: The mobile computing function can be logically divided into following major segments. 1. User with device: The user could have fixed device like desktop computer or portable device like mobile phone, PDA etc. 2. Network: When user is mobile, he will used different network at different place at different time. 3. Gateway: This is required to interface different transport bearer. This gateway convert one specific transport bearer to another bearer (environment). 4. Middleware: It is a software layer between user application and operating system. 5.Content: It is a place or server where originally the content is stored. This could be an application, system or even collection of system.	***Functions 3M***
	(b)	**Draw diagram and explain Co-channel interference (CCI) and Adjacent channel interference (ACI).**	**4M**
	Ans.	**Co-channel interference:** Due to frequency reuse, several cells in a same coverage area use same frequency. These cells are known as co-channel cell. The interference between signals from these co-channel cells is called co-channel interference. Co-channel interference cannot be reduced by simply increasing the carrier power of transmitter. If we increase transmit power of carrier, it will increase interference to neighboring	***Each diagram 1M***

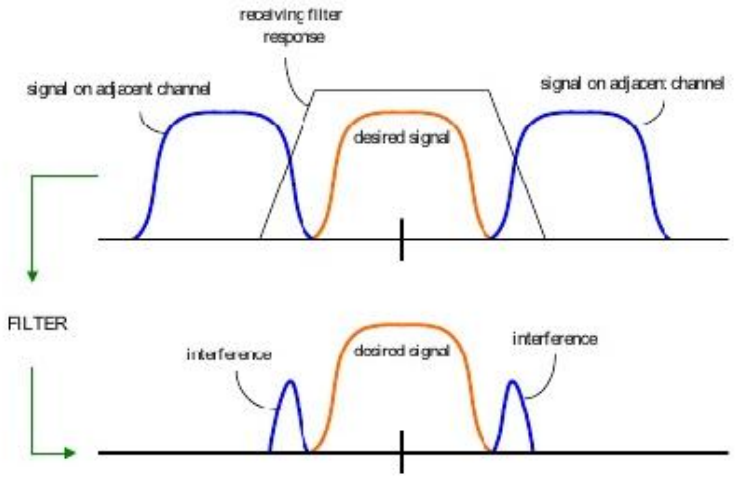
channel cell. The diagram below shows co Channels using same frequency. The distance between the 2 Co- Channels is D

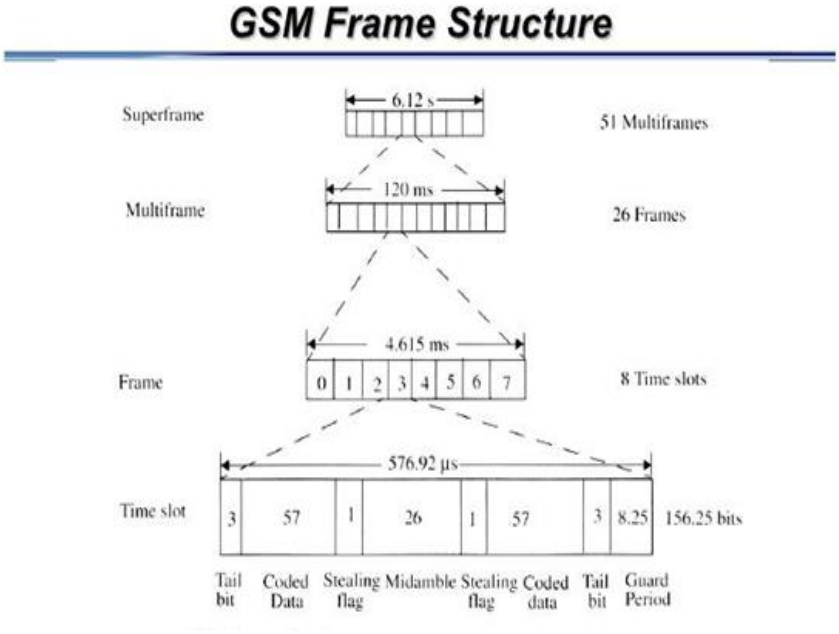


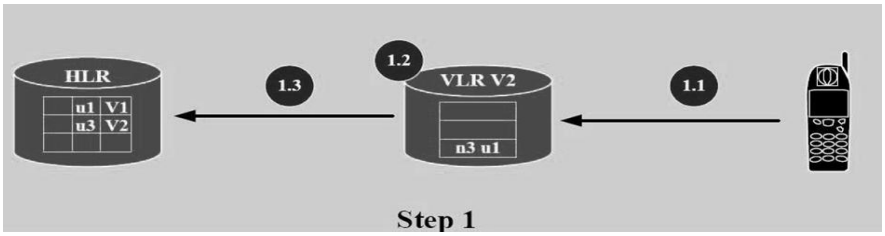
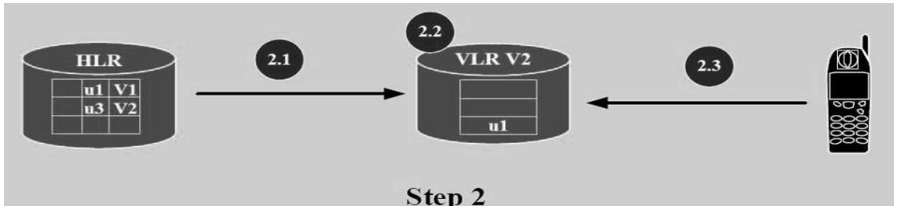
Each explanation 1M

Adjacent channel interference:

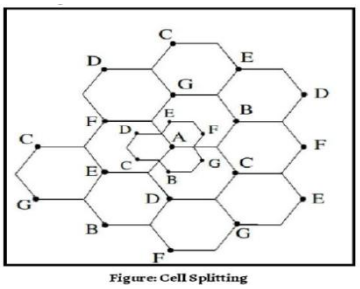
Adjacent channel interference occurs in a radio **channel** when unwanted energy from **channels adjacent** to it falls into its desired bandwidth. In a **mobile** radio environment, the desired signal and the **interference** signal usually experience path loss and fading when they travel from the transmitter to the receiver



	(c) Ans.	**With neat labelled diagram, describe GSM frame architecture.**  **Frame structure in GSM:** 1. The length of GSM frame in a frequency channel is 4.615 ms. 2. The frame is divided into 8 bursts of length of 0.577ms 3. The timeslots in the uplink are derived from downlink by a time delay of 3 time slots 4. This arrangement prevents an MS from transmitting and receiving at the same time 5. However, due to propagation delay (when MS is far away from BTS) the 3 TS delay cannot be maintained accurately.	**4M** ***Diagram 2M*** ***Description 2M***
	(d) Ans.	**Explain VLR overflow control algorithm for registration.** When a VLR is full, the incoming mobile users cannot receive cellular services • To solve VLR overflow problem, overflow control algorithms O-I, O-II, O-III, and O-IV are presented. • An extra flag (1 bit) is required in the HLR records	**4M**

		Registration:  Step 1 **Step 1: Registration Request:** **Step 1.1** same as step 1 of the normal registration procedure **Step 1.2** V2 is full. V2 follows a replacement policy to select a record to be deleted (u3 in Fig.). The storage for the delete record is used to store u1"s information. The selected user (i.e., u3) is called overflow user. The replacement policy may be based on various heuristics **Step 1.3** V2 forwards the registration request to the HLR with indication that u3's record is deleted due to database overflow  Step 2 **Step 2: Registration Response:** **Step 2.1** HLR update the location of u1, and sets the overflow flag in u3's record **Step 2.2** HLR acknowledges the registration operation and sends u1's profile to V2. **Step 2.3** V2 sends an acknowledgment to MS	***Algorithm for registration 2M*** ***Diagram 2M***
	(e) Ans.	**List applications and limitations of GPRS.** **Applications:** **1**. Generic applications: information services, web browsing, internet access, email etc which are useful when mobile. Mass market applications offering contents like sports, scores, weather, flight info, news headlines, lottery results, horoscopes, traffic info etc.. Mobile banking , Mobile commerce are other generic applications 2. CHAT: Groups of common minded people use chat services as a means to communicate and discuss matter of common interest. GPRS	**4M** ***Any two applications 2M***

		offers by integrating internet chat and wireless chat using SMS & WAP 3. Vehicle Positioning: This application integrates GPS . This will provide service which includes remote vehicle diagnostics, stolen vehicle tracking and in logistics industry 4. Still images such as photographs, pictures, postcards, greeting cards and presentations, static web pages can be sent and received over the mobile network. **Limitations:** 1. Limited Cell Capacity for All Users: GPRS does impact a network's existing cell capacity. There are only limited radio resources that can be deployed for different uses 2. Speeds Much Lower in Reality 3. Achieving the theoretical maximum GPRS data transmission speed of 172.2 kbps would require a single user taking over all eight timeslots without any error protection.	***Any two limitations 2M***
	(f) **Ans.**	**Explain stream ciphering and block ciphering.** ***(Note: Any relevant explanation with suitable example may also be considered)*** A **block cipher** processes the input one block of elements at a time, producing an output block for each input block. A stream cipher processes the input elements continuously, producing output one element at a time, as it goes along. A stream cipher is one that encrypts a digital data stream one bit or one byte at a time. Block ciphers in general process the plaintext in relatively large blocks at a time. A block cipher is one in which a block of plaintext is treated as a whole and used to produce a ciphertext block of equal length. Typically, a block size of 64 or 128 bits is used. As with a stream cipher, the two users share a symmetric encryption key. The encryption function is the same for every block. A block cipher can be represented by a directive function f which accepts as input a block of plaintext of a fixed size, and a key, and outputs a block of ciphertext, as shown in following equation: $f(p; k) = c$	**4M** ***Each explanation 2M***

		Stream ciphers, on the other hand, process plaintext in small blocks (sometimes as small as a single bit). In contrast to block ciphers, stream ciphers keep some sort of memory, or state, as it processes the plaintext and uses this state as an input to the cipher algorithm. More specifically, a stream cipher is two functions, f and g, as given in below equations: $ut + 1 = f(ut; pt; k)$ (2) $ct = g(ut; pt; k)$ f is the next state function, which gives the current state, the next block of plaintext, and the key produces a new state. g is the output function, which given the same three inputs produce a block of ciphertext as output. Note that then next time f and g is called (at time t + 1), the state will be different.	
3.	**(a)** **Ans.**	**Attempt any FOUR of the following:** **Describe any two techniques for improving coverage and capacity in cellular system.** **Techniques for improving coverage and capacity in cellular system:** Cell splitting Cell sectoring Microcell-zone concept **Cell splitting** is the process of subdividing congested cell into smaller cells, each with its own base station and a corresponding reduction in antenna height and transmitter power. **Cell splitting** increases capacity of a cellular system since its increases the number of times that channels are reused.  Figure: Cell Splitting	**16** **4M** ***2M each for any two techniques***

Cell sectoring increases SIR using directional antennas, then capacity improvement is achieved by reducing the number of cells in a cluster, thus increasing frequency reuse.

Often wireless operator needs to provide dedicated coverage for hard-to-reach areas. Such as within buildings, or in valleys or tunnels. Radio transmitters, known as **— repeaters** are often used to provide such range (coverage) extension capabilities.

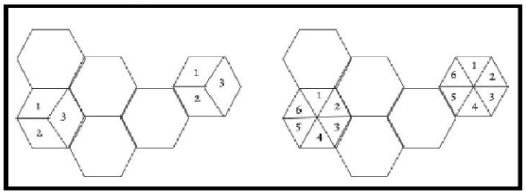


Figure: Cell Sectoring (120° & 60°)

Microzone cell concept:

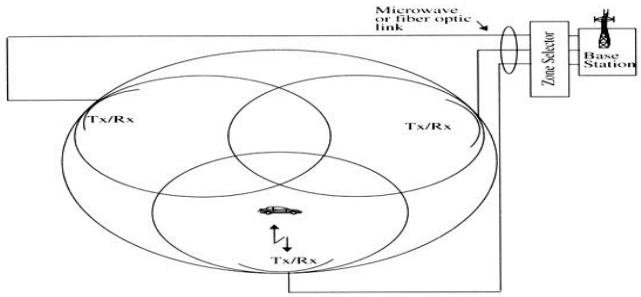
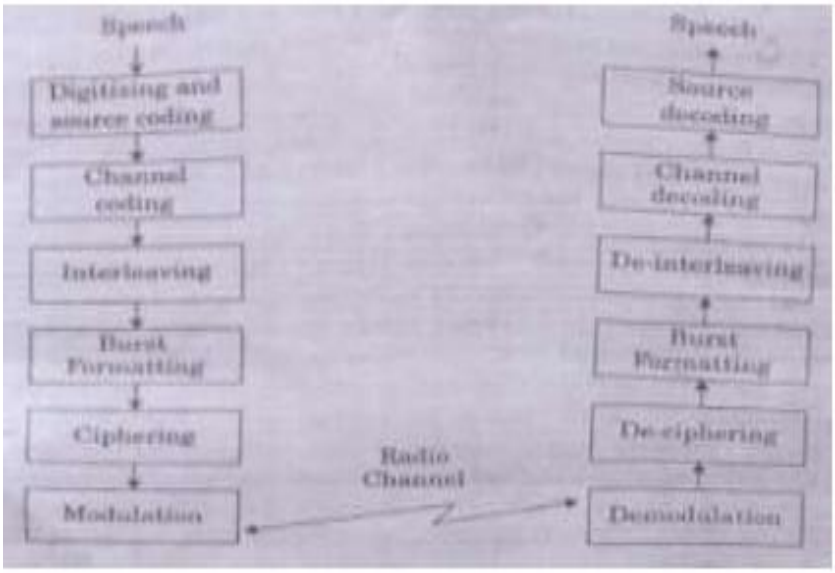
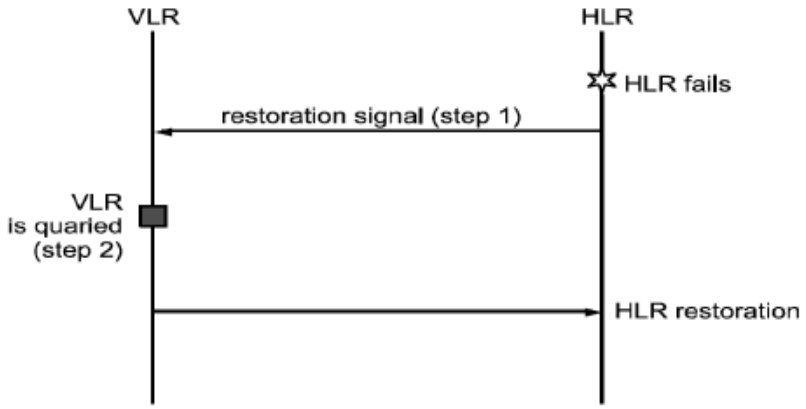


Figure The microcell concept

The problem associated with sectoring technique is the increase in number of handoffs. This puts an additional load on the switching and control link elements of the mobile system. A solution to this problem is microcell concept. In this scheme, all the three or more zone sites represents as Tx/ Rx are connected to the same base station and share the same radio equipment. The transmission media used for connecting the zones to the base station are coaxial cable, fiber optics cable or a microwave link. So each cell consists of a base station and multiple zones. A mobile travelling within a cell, is served by the zone that has the strongest signal of all. The antennas in zones are placed at the outer edges of the cell and any base station channel can be assigned to any zone by the base station. As a mobile travels from

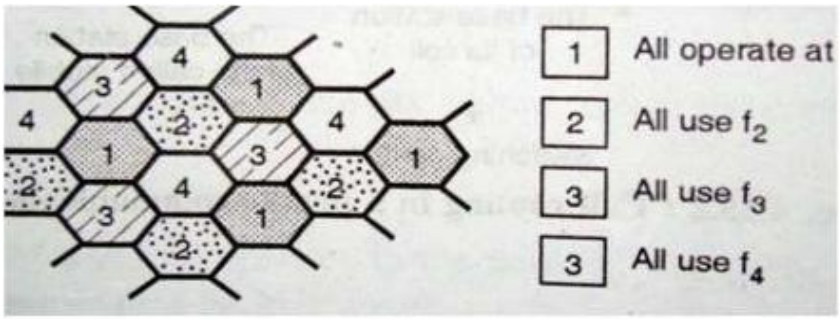
		one zone to the other within a cell, it uses the same channel. This will avoid hand-off. The base station will just switch the channel to the appropriate zone sit. Thus a given channel is being used only in a particular zone in which the mobile is travelling. So the base station radiation is localized. This will reduce interference. The channels are distributed in time and space by all the zones are also reused in the co- channels cells. The microcell concept is very useful along highways or in the busy urban areas.	
	(b) Ans.	**Explain signal processing in GSM with block diagram.** **Signal processing in GSM:**  **Speech Coding:** The coder provides 260 bits for each 20 ms blocks of speech, which yield a bit rate of 13 Kbps. **Channel Coding:** The output bits of the speech coder are ordered in to groups for error protection, based on their significance in contributing to, speech quality. Out of the total 260 bits in a frame, the most important 50 bits called (Ia bits) have 3 parity check (CRC) bits added to them. This facilitate the non correctable errors at the receiver. The next 132 bits (Type Ib) along with 53 bits are recorded and appended by providing a data block of 189 bits. This block is then encoded for error using rate ½ convolutional encoder. The least important 78 bits (Type 2) are not error protected and are just joined to form 456 bits in	**4M** ***2M diagram*** ***2M Explanation***

		a 20 ms frame. **Interleaving:** The 456 bit in 20 ms speech frame is broken in to eight 57 bit subblocks. They form the consecutive TCH time slots. **Ciphering:** It modifies the contents of the eight interleaved blocks through the use of encryption techniques known only to a particular mobile station and bas transreceiver. **Burst Formatting:** Adds binary data to the ciphered blocks to help synchronization and equalization of the received signal. **Modulation:** It is 0.3 GMSK. It is a type of digital FM.1's and 0's are represented by shifting the RF carrier by + - 67.708KHz. **Demodulation:** The appropriate TS is demodulated with the aid of synchronization data provided by the burst formatting. After demodulation, the binary info is deciphered, de-interleaved, channel decoded and speech decoded.	
	(c) Ans.	**Explain HLR failure restoration procedure.** **HLR failure restoration:** In GSM HLR, it is compulsory to save the update into non-volatile storage. Changes of service information are backup immediately after every update and the location information is periodically transferred from HLR into backup. The service information is update infrequently because not all the subscriber changes their service profile after subscription. After HLR failure, the data in the backup are reloaded in to the HLR. We also have "uncovered period" as a time interval after last backup operation and before the restart of the HLR data that changed in the uncover period cannot be recovered. The following HLR restoration procedure is executed. **Step 1:** The HLR sends an signalling system 7 (SS7) TCAP (Transaction Capability Application Part) message. MAP_RESET to the all VLRs where its MSs are located (that is restoration signal). **Step 2:** Each VLR that receives the restoration signal from HLR is queried to search the lost location information of user.	**4M** ***Explanation 2M***

		Step 3: All the VLRs derived all MSs of the HLR, and for each MS, they send an SS7 TCAP message, MAP_UPDATE LOCATION, to the HLR.  **HLR restoration**	***Diagram 2M***
	(d) Ans.	**Describe CDMA 2000.** **3 G CDMA 2000:** 1. Code division multiple access 2000 is the natural evolution of IS-95 (cdma One).It includes additional functionality that increases its spectral efficiency and data rate capability.(Code division Multiple access) is a mobile digital radio technology where channels are defined with codes (PN Sequences). 2. CDMA permits many simultaneous transmitters on the same frequency channel. Since more phones can be served by fewer cell sites, CDMA –based standards have a significant economic advantage over TDMA or FDMA-based standards. 3. This standard is being developed by Telecommunications Industry Association (TIA) of US and is standardized by 3GPP2. 4. The main CDMA 2000 standards are: CDMA 2000 1xRTT, CDMA 2000 1xEV and CDMA 2000 EV-DV. **CDMA 2000 1xRTT:** RTT stands for Radio Transmission Technology and the designation "1x" meaning "1 times Radio Transmission Technology", indicates the same RF bandwidth as IS-95.The main features of CDMA 2000	**4M** ***Description 4M***

		1X are as follows: 1. Supports an instantaneous data rate up to 307 Kbps for a user in packet mode and a typical throughput rates of 144 Kbps per user, depending on the number of user, the velocity of user and the propagating conditions. 2. Supports up to twice as many voice users a the 2G CDMA Standard. 3. Provides the subscriber unit with up to two times the standby time for longer lasting battery life. **CDMA 2000 EV:** This is an evolutionary advancement of CDMA with the following characteristics: 1.Provides CDMA carriers with the options of installing radio channels with data only (CDMA 2000 EV-DO) and with data and voice (CDMA 2000 EV-DV) 2. The CDMA 2000 1xEV-DO supports greater than 2.4 Mbps of instantaneous high speed packet throughput per user on a CDMA channel, although the user data rates are much lower and highly dependent on other factors. 3. CDMA 2000 EV-DV can offer data rates up to 144 Kbps with about twice as many voice channels as IS-95B. **CDMA 2000 3x:** 1. It is (also known as EV-DO Rev B) is a multi-carrier evolution. 2. It has higher rates per carrier (up to 4.9 Mbps on the downlink per carrier).Typical deployments are expected to include 3 Carriers for a peak rate of 14.7 Mbps. Higher rates are possible by bundling multiple channels together. It enhances the user experience and enables new services such as high definition video streaming. 3. Uses statistical multiplexing across channels to further reduce latency, enhancing the experience for latency-sensitive services such as gaming, video telephony, remote console sessions and web browsing. 4. It provides increased talk-time and standby time. 5. The interference from the adjacent sectors is reduced by hybrid frequency reuse and improves the rates that can be offered, especially to users at the edge of the cell. 6. It has efficient support for services that have asymmetric download	

		and upload requirements (i.e different data rates required in each direction) such as file transfers, web browsing, and broadband multimedia content delivery.	
	(e) Ans.	**State four features of Linux OS.** **Features of Linux OS:** **1.Portable:** Portability means softwares can works on different types of hardwares in same way. Linux kernel and application programs support their installation on any kind of hardware platform. **2.Open Source:** Linux source code is freely available and it is community based development project. Multiple teams works in collaboration to enhance the capability of Linux operating system and it is continuously evolving. **3.Multi-user:** Linux is multiuser system means multiple users can access system resources like Memory/RAM/Application programs at same time. **4.Multiprogramming:** Linux is a multiprogramming system means multiple applications can run at same time. **5.Hierarchical File System:** Linux provides a standard file structure in which system files/user files are arranged. **6.Shell:** Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs etc. **7.Security:** Linux provides user security using authentication features like password protection/controlled access to specific files/encryption of data.	**4M** ***Any four features 1M each***
4.	**(A) (a) Ans.**	**Attempt any THREE of the following:** **Explain frequency reuse concept. State its advantages.**	**12** **4M**



Frequency reuse is the process in which the same set of frequencies (channels) can be allocated to more than one cell. Provided the cells are separated by sufficient distance reducing each cells coverage area invites frequency reuse cells using the same set of radio channels can avoid mutual interference, provided they are properly separated. Each cell base station is allocated a group of channel frequencies that are different from those of neighboring cells & base station antennas are chosen to achieve a desired coverage pattern within its cell. However as long as a coverage area is limited to within a cells boundaries the same group of channel frequencies may be used in different cells without interfacing with each other provided the two cells are sufficient distance from one another.

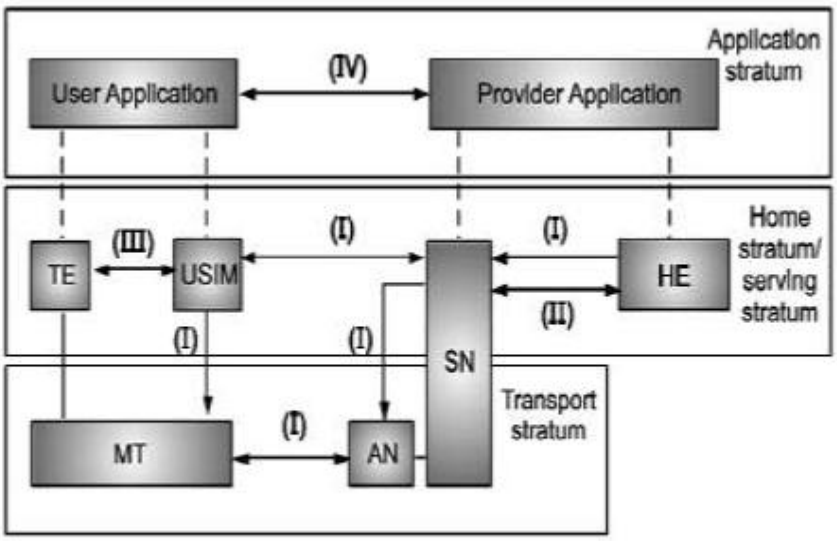
Frequency 2M

Advantages:

- Higher capacity
  - More frequent resource utilization increases the capacity
- Less transmission power
  - Reduced cell sizes, less power needed to cover the cell area
  - Relaxed power amplifier specs at base stations
  - Longer life-time for mobile station batteries
- Localized interference
  - Due to smaller service areas of cells, interference is as well localized to a smaller area
- Robusiness
  - In case that one cell is down, overlapping of cells guarantees that a mobile is able to get connected through other base stations
- No technological challenges in deployment

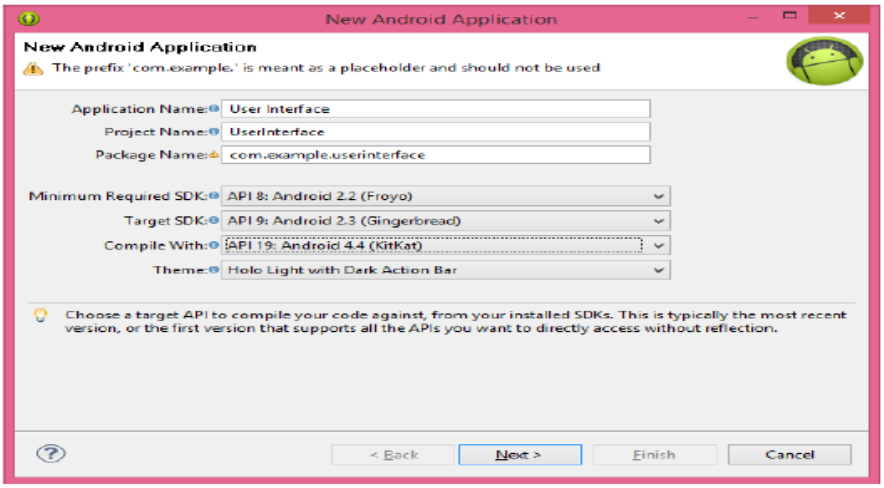
Any two advantages 1M each

		• Major problems related to minimizing the implementation and operational expenses of the system • Technological challenges related to capacity improvement methods.	
	(b) Ans.	**Explain GSM. Location tracking & call setup, procedure.** **Location tracking:** A GSM network is divided in to cells. A group of cells is considered a location area. A mobile phone in motion keeps the network informed about changes in the location area. If the mobile moves from a cell in one location area to a cell in another location area, the mobile phone should perform a location area update to inform the network about the exact location of the mobile phone. The HLR maintains a database for the mobile subscribers. At any point of time, the HLR knows the address of the MSC VLR that controls the current location area of the mobile. The HLR is informed about a location area update only if the location area change has resulted in a change of the MSC VLR. Visitor Location Register (MSC VLR) is responsible to switching voice calls and it also keeps track of the exact location area where mobile user is present. **Call Setup in GSM:** 1. Channel Request: The MS requests for the allocation of a dedicated signaling channel to perform the call setup. 2. After allocation of a signaling channel the request for MOC call setup, included the TMSI (IMSI) and the last LA1, is forwarded to the VLR. 3. The VLR initiates Authentication, Cipher start, IMEI check (optional) and TMSI Re-allocation (optional). 4. If all this procedures have been successful, MS sends the setup information (number of requested subscriber and detailed service description) to the MSC. 5.The MSC requests the VLR to check from the subscriber data whether the requested service an number can be handled (or if there are restrictions which do not allow further proceeding of the call setup) 6. If the VLR indicates that the call should be preceded, the MSC commands the BSC to assign a Traffic channel (i.e resources for speech data transmission) to the MS. 7. The BSC assigns a Traffic channel TCH to the MS.	**4M** ***GSM Location tracking 2M*** ***Call setup 2M***

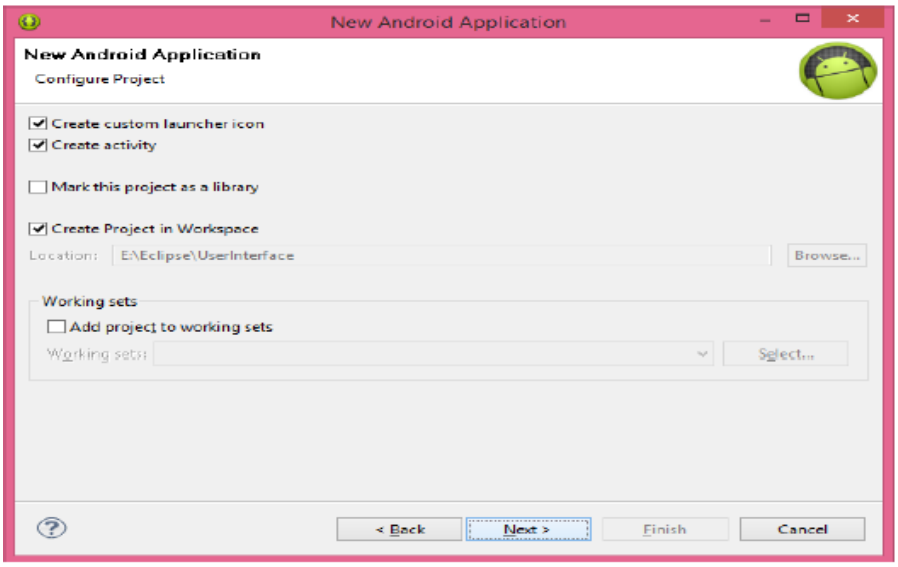
		8. The MSC sets up the connection to requested number (called party).	
	(c) Ans.	**With neat diagram, describe 3G security architecture.**  **Fig Overview of the 3G security architecture** Figure gives an overview of complete 3G Security architecture From fig four security feature groups are defined. Each of these feature groups meets certain threats, accomplishes certain security objectives: **1. Network access security(I):** The set of security features that provide users with secure access to 3G. **2. Network domain security(II):** The set of security features that enable nodes in the provider domain to securely exchange signalling data, and protect against attacks on the wireline network. **3. User domain security(III):** The set of security features that secure access to mobile stations. **4. Application domain security(IV):** The set of security features that enable applications in the user and in the provider domain to securely exchange messages**.**	**4M** ***Diagram 2M*** ***Description 2M***

	(d) Ans.	**Explain the multifactor security.** Multifactor security implies to a system that requires more than one method of authentication from independent categories of credentials to verify the user's identity for a login or other transaction. Multifactor security can be a combination of any of the following factors: **1.What You Know:** The idea here is that you know a secret often called a password that nobody else does. Thus, knowledge of a secret distinguishes you from all other individuals. And the authentication system simplify needs to check to see if the person claiming to be you knows the secret. a) Password b) Pass Phrase c) PIN d) Answer to some personal question e) Sequence of a Number f) Predetermined events. **2.What You Have:** a) Instead of basing authentication on something a principal knows and can forget, may be we should base it on something the principal has. Various token/card technologies support authentication along these lines. For all, 2-factor authentication becomes important an authentication process that involves 2 independent means of authenticating the principal. So we might require that a principal not only possess a device but also know some secret password(often known as a PIN, or personal identification number).Without 2-factoe authentication, stealing the device would allow an attacker to impersonate the owner of the device; with 2-factor authentication, the attacker would still have another authentication burden to overcome. **b)Magnetic strip card:** eg. credit card. One serious problem with these cards is that they are fairly easy to duplicate. It only costs about doller 50 to buy a writer, and its easy to get your hands on cards to copy them. To get around these problems, banks implement 2-factor authentication by requiring knowledge of a 4 to 7 character PIN whenever the card is used. **3.What You Are:** Since people forget things and lose things, one might contemplate basing an authentication scheme for humans on something that a person is. After all, we recognize people we interact with not because	**4M** ***Definition 1M*** ***3 Factors 1M each***

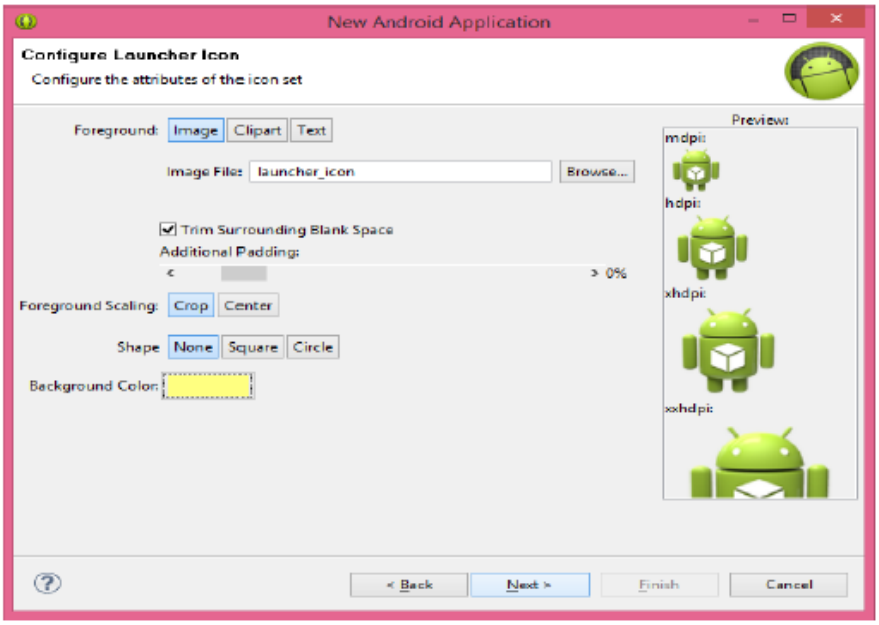
		of some password protocol but because of how they look or how they sound----"something they are". Authentication based on "something you are" will employ behavioural and physiological characteristics of the principal. These characteristics must be easily measured accurately and preferably are things that are difficult to spoof. For example, we might use a) Retinal scan b) Fingerprint reader c) Handprint reader d) Voice print e) Keystroke timing f) Signature g) Face(picture in passport) h) Biometrics	
4.	**(B)** **(a)** **Ans.**	**Attempt any ONE of the following:** **Explain GSM control channel types.** **GSM control channel (CCH):** **1) Broadcast channel (BCH):** **a) Broadcast control channel (BCCH):** The BCCH is a forward control channel that is used to broadcast information such as cell and network identity, operating characteristics of the cell (current control channel structure, channel availability and congestion).The BCCH also broadcast a list of channels that are currently in use within the cell. **b) Frequency correction channel (FCCH):** (a) The FCCH allows each subscriber unit to synchronize its internal frequency standard (local oscillator) to the exact frequency of the base station. **(c)Synchronization channel (SCH):** SCH is used to identify the serving BS while allowing each mobile to frame synchronizes with the BS. The frame number (FN) is sent with the base station identity code (BSIC) during the SCH burst. **b) Common control channel (CCCH):** (a) **Paging channel (PCH):** The PCH provides paging signals from the BS to all mobiles in the cell, and notifies a specific mobile of an incoming call which originates from PSTN. PCH may be used to provide cell broadcast ASCII text messages to all subscribers. (b) **Random Access Channel (RACH):** The RACH is a reverse link channel used by a subscriber unit to acknowledge a page from the	**6** **6M** ***Correct explanation 6M***

		PCH and is also used by mobiles to originate a call. (c) **Access grant channel (AGCH):** The AGCH is used by the BS to provide forward link communication to the mobile, and carries data which instructs the mobile to operate in a particular physical channel. **c) Dedicated control channel (DCCH):** (a) **Stand-alone Dedicated control channel (SDCCH):** The SDCCH carries signaling data following the connection if the mobile with the BS, and just before TCH assignment issued by the BS. The SDCCH ensures that the mobile station and base station remain connected while the BS and MSC verifies subscriber unit. (b) **Slow Associated Control Channel (SACCH):** On the forward link the SACCH is used to send slow but regularly changing control information to the mobile such a transmit power level instruction. On the reverse link the SACCH carries information about the received signal strength. (c) **Fast Associated Control Channel (FACCH):** FACCH carries urgent messages and contains essentially the same type of information as SDCCH.	
	(B) **Ans.**	**Write a stepwise procedure to create program for user interface in android.** Open eclipse: Click the menu file –New Android Application Project 1. Name the project: In this stage, there exist three names described as: Specify Application Name, Project Name, Package name. 	**6M** ***Correct steps without diagram 4M*** ***Output diagram 2M***

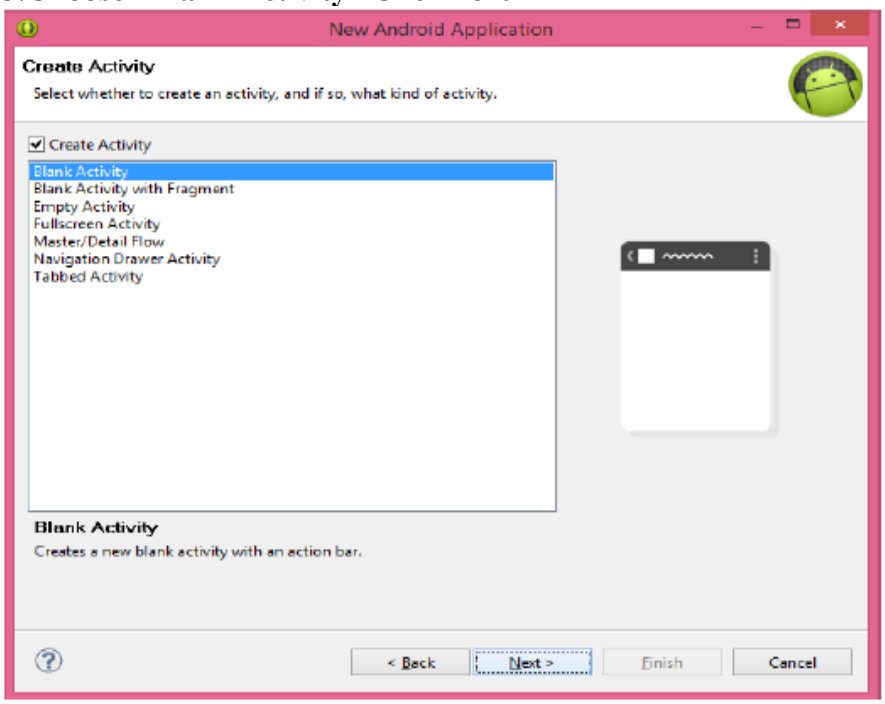
1.Click Next



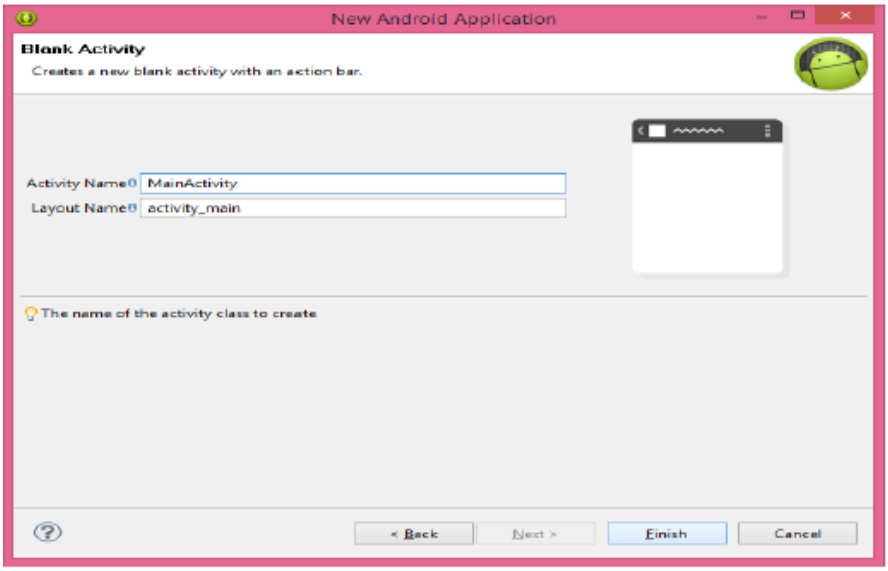
2.Configure Launcher Icon:



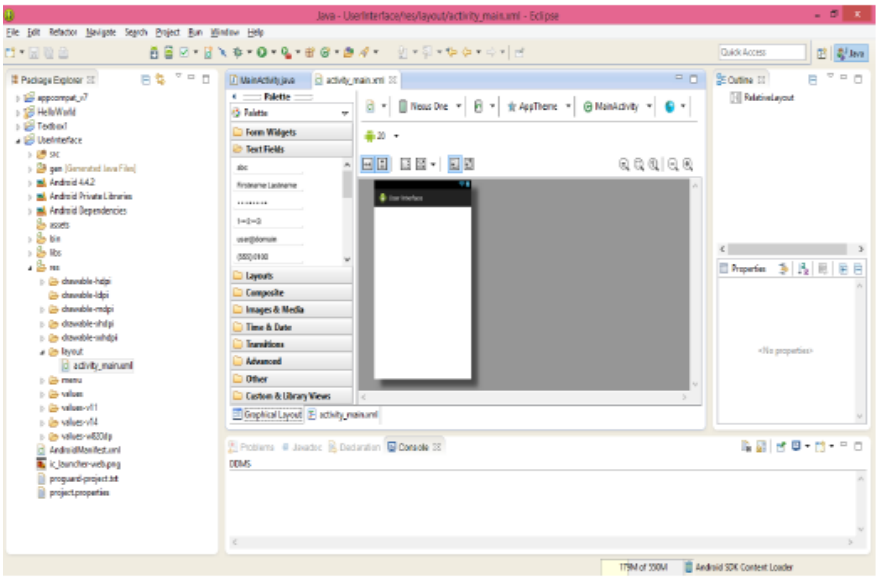
3.Choose "Blank Activity" Click next



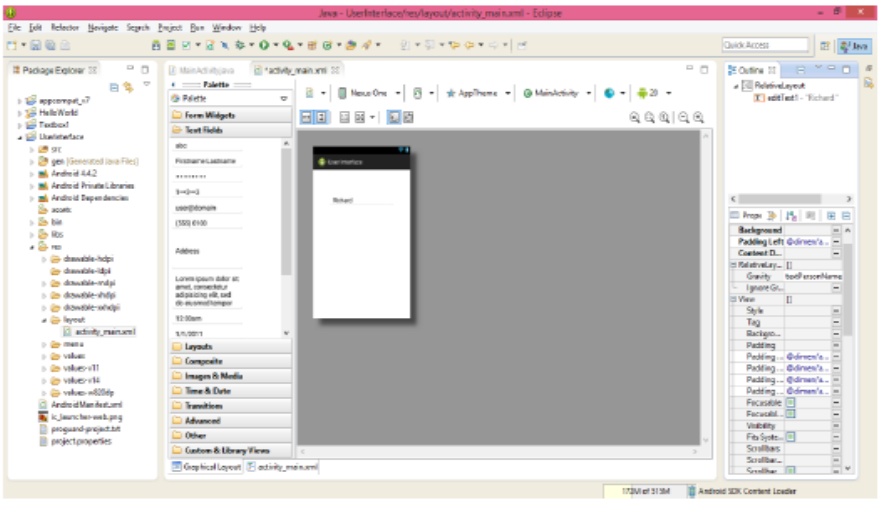
4. It will display Activity Name and Layout Name Click finish



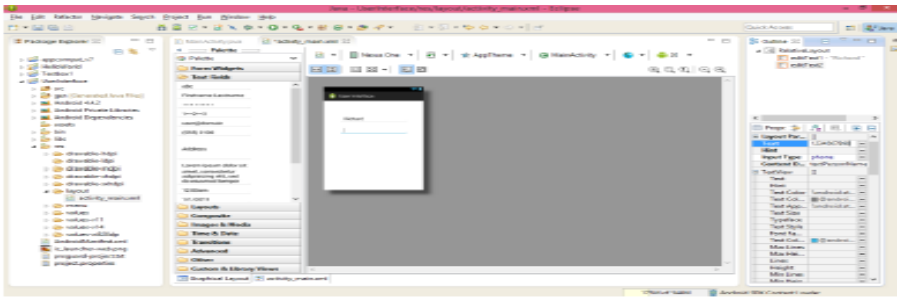
5. In Activity_main.xml file under text field folder we can see the different types of text fields for providing text, password, numbers, email-id etc.

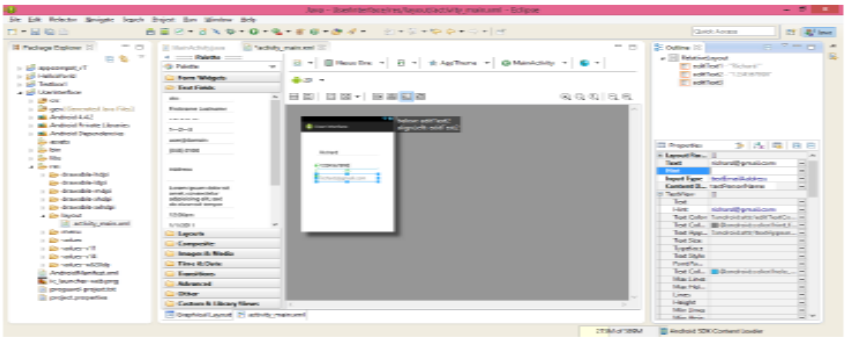


6.Drag the desired text field on the graphical layout of the GUI and enter the desired input in respect to the type of text filed

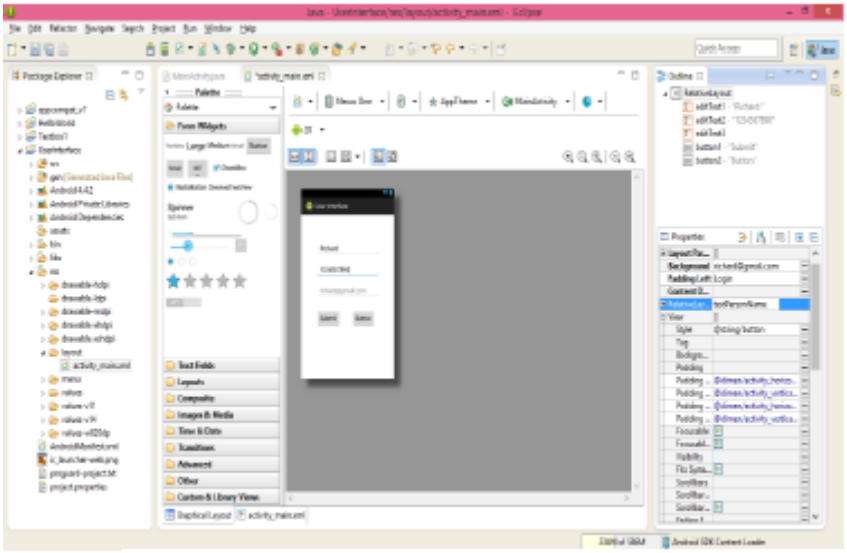


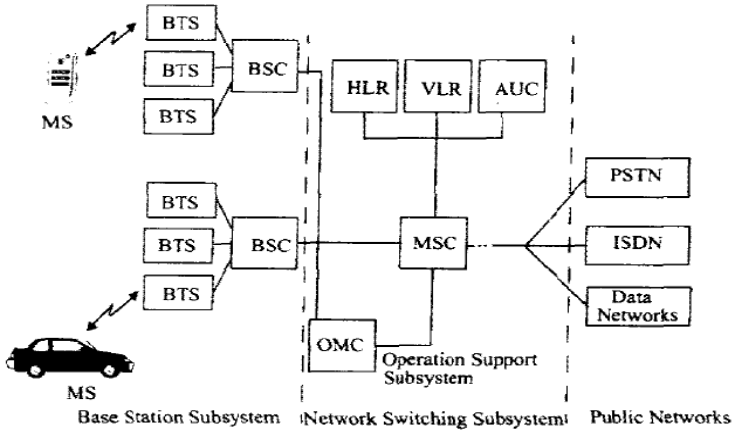
7.Select another text filed and provide the input





8. From the form widgets menu select the buttons you want and rename it as required



		Output: To run User Interface application launch AVD (Android Virtual Device) Open project's activity files from eclipse and click Run icon from the toolbar. Eclipse installs the app on your AVD and starts it and if everything is fine with your setup and application, it will display following Emulator window. You can also run this application directly on your android device instead of AVD. First you need to enable USB debugging on your phone, then connect it to your computer via USB. Then eclipse will automatically start debugging on your phone instead of the AVD. **Output diagram:** 	
5.	**(a) Ans.**	**Attempt any TWO of the following:** **With a block diagram, describe GSM architecture.** **GSM System Architecture:** 	**16** **8M** ***Diagram 3M***

		• The GSM system architecture consists of three major interconnected subsystems that interact between themselves and with the users through certain network interfaces. • The subsystems are the Base Station Subsystem (BSS), Network and Switching Subsystem (NSS), and the Operation Support Subsystem (088). • The Mobile Station (MS) is also a subsystem, but is usually considered to be part of the BSS for architecture purposes. Equipment and services are designed within GSM to support one or more of these specific subsystems. • The BSS, also known as the radio subsystem, provides and manages radio transmission paths between the mobile stations and the Mobile Switching Center (MSC). The BSS also manages the radio interface between the mobile stations and all other subsystems of GSM. Each BSS consists of many Base Station Controllers (BSCs) which connect the MS to the NSS via the MSCs. • The NSS manages the switching functions of the system and allows the MSCs to communicate with other networks such as the PSTN and ISDN. • The Mobile Stations (MS) communicate with the Base Station Subsystem (BSS) over the radio air interface. The BSS consists of many BSCs which connect to a single MSC, and each BSC typically controls up to several hundred Base 1Tansceiver Stations (BTSs). • Some of the BTSs may be co-located at the BSC, and others may be remotely distributed and physically connected to the BSC by microwave link or dedicated leased lines. Mobile handoffs (called handovers, or HO, in the GSM specification) between two BTSs under the control of the same BSC are handled by the BSC, and not the MSC. This greatly reduces the switching burden of the MSC. • As shown in Figure, the interface which connects a BTS to a BSC is called the Abis interface. • The Abis interface carries traffic and maintenance data, and is specified by GSM to be standardized for all manufacturers. • In practice, however, the Abis for each GSM base station manufacturer has subtle differences, thereby forcing service providers to use the same manufacturer for the BTS and BSC	***Description 5M***

		equipment. • The BSCs are physically connected via dedicated/leased lines or microwave link to the MSC. The interface between a BSC and a MSC is called the A interface, which is standardized within GSM. • The A interface uses an SS7 protocol called the Signaling Correction Control Part (SCCP) which supports communication between the MSC and the BSS, as well as network messages between the individual subscribers and the MSC. • The A interface allows a service provider to use base stations and switching equipment made by different manufacturers.	
	(b) Ans.	**Explain GPRS network nodes.** **GPRS Network Nodes:** A GSN is a network node which supports the use of GPRS in the GSM core network. All GSNs should have a *GN* interface and support the GPRS tunneling protocol. There are two key variants of the GSN, namely Gateway and Serving GPRS support node. 1. GPRS Support Nodes, 2. Gateway GPRS Support Nodes **GPRS Support Nodes:** Following two new components, called Gateway GPRS Support Nodes (GSNs) and, Serving GPRS Support Node (SGSN) are added: **1. Gateway GPRS Support Node (GGSN)** The Gateway GPRS Support Node acts as an interface and a router to external networks. It contains routing information for GPRS mobiles, which is used to tunnel packets through the IP based internal backbone to the correct Serving GPRS Support Node. The GGSN also collects charging information connected to the use of the external data networks and can act as a packet filter for incoming traffic. **2. Serving GPRS Support Node (SGSN)** The Serving GPRS Support Node is responsible for authentication of GPRS mobiles, registration of mobiles in the network, mobility management, and collecting information on charging for the use of the air interface.	**8M** ***Each Network support node 4M***

	(c) Ans.	**List and explain components of information security.** **Component of Information Security** Information security is an art of keeping the message secret in to encrypt and hide it from others getting to know it. The components are: (CIANATA) 1. Confidentiality 2. Integrity 3. Availability 4. Non- repudiation 5. Authorization 6. Trust 7. Accounting 1. **Confidentiality**: It is the property where the information is kept secret so that unauthorized persons cannot get at the information. It is ensured through Encryption of data. 2. **Integrity**: Integrity is achieved by adding additional information into a message. It is done through checksums, message digests or digital signature. The receiver of the message checks this extra information to verify whether the message has been tampered. 3. **Authentication** is a process by which we validate the identity of the parties involved in a transaction. 4. **Non – repudiation**, we identify the identity of these parties beyond any point of doubt. Non repudiation does not allow the sender of the message to refute the claim of not sending that message 5. **Availability:** Media management is part of the larger security framework. It is essential to ensure availability of service. 6. **Trust:** Trust involves developing a security policy, assigning credentials to entities, verifying that credentials fulfill the policies 7. **Accounting:** It is the process by which usage of service is metered. Based on the usage, the service provider collects the fees either directly from the customer or through home network. This will be true even if the user is roaming in a foreign network and using the services in a foreign network	**8M** ***List 1M*** ***Each component explanation 1M***
6.	**(a)** **Ans.**	**Attempt any FOUR of the following:** **With a diagram, describe Hand off procedure. List the types of Hand offs.**	**16** **4M**

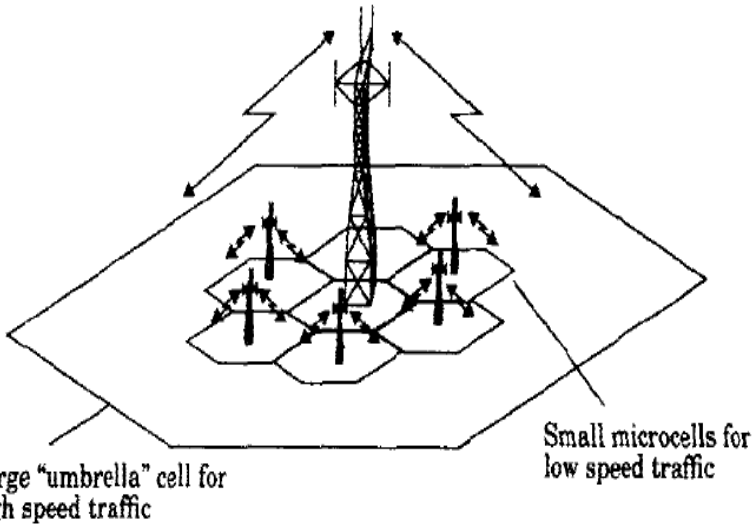


Diagram 1M

- When a mobile move into a different cell while a conversation is in progress, the MSC automatically transfers the call to new channel belonging to the new base station.
- This handoff operation not only involves identifying a new base station, but also requires that the voice and control signals be allocated to channels associated with the new base station.
- Processing handoffs is an important task in any cellular radio system. Many handoff strategies prioritize handoff requests over call initiation requests when allocating unused channels in a cell site.
- Handoffs must be performed successfully and as infrequently as possible, and be imperceptible to the users.
- In order to meet these requirements, system designers must specify an optimum signal level at which to initiate a handoff.
- Once a particular signal level is specified as the minimum usable signal for acceptable voice quality at the base station receiver a slightly stronger signal level is used as a threshold at which a hand off is made.
- During the course of a call, if a mobile move from one cellular system to a different cellular system controlled by a different MSC, an intersystem handoff becomes necessary.
- An MSC engages in an intersystem handoff when a mobile signal becomes weak in a given cell and the MSC cannot find another

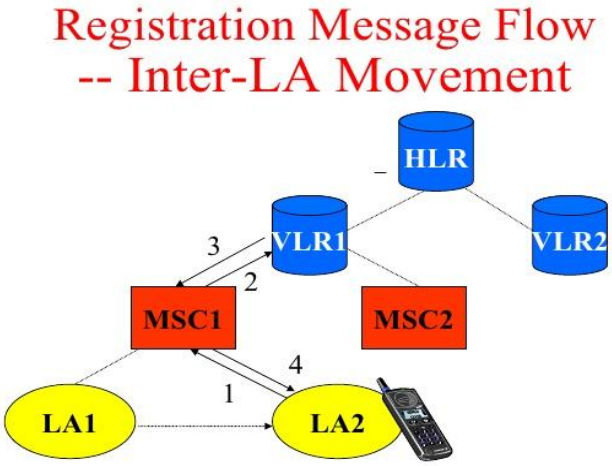
Description 2M

		cell within its system to which it can transfer the call in progress. • There are many issues that must be addressed when implementing an intersystem handoff. **Different systems available in handoff** 1. Soft Handoff 2. Hard handoff	***Types 1M***
	(b) Ans.	**Describe the process of GSM to PSTN call.** • To understand how the various traffic and control channels are used, consider the case of a mobile call origination in GSM. First, the subscriber unit must be synchronized to a nearby base station as it monitors the BCH. • By receiving the FCCH, SCH, and BCCH messages, the subscriber would be locked on to the system and the appropriate BCH. To originate a call, the user first dials the intended digit combination and presses the "send" button on the GSM phone. • The mobile transmits a burst of RACH data, using the same ARFCN as the base station to which it is locked. The base station then responds with an AGCH message on the CCCH which assigns the mobile unit to a new channel for SDCCH connection. • The subscriber unit, which is monitoring TS 0 of the BCH, would receive its ARFCN and *TS* assignment from the AGCH and would immediately tune to the new ARFCN and TS. • This new ARFCN and TS assignment is physically the SDCCH {not the TCH). Once tuned to the SDCCH, the subscriber unit first waits for the SACCH frame to be transmitted when calls are originated from the PSTN, the process is quite similar. • The base station broadcasts a PCH message during TS 0 within an appropriate frame on the BCH. The mobile station, locked on to that same ARFCN, detects its page and replies with an RACH message acknowledging receipt of the page. • The base station then uses the AGCH on the CCCH to assign the mobile unit to a new physical channel for connection to the SDCCH and SACCH while the network and the serving base station are connected. • Once the subscriber establishes timing advance and authentication on the SDCCH, the base station issues a new physical channel assignment over the SDCCH, and the TCH assignment is made.	**4M** ***Explanation -4M***

SUMMER – 2019 EXAMINATION
MODEL ANSWER

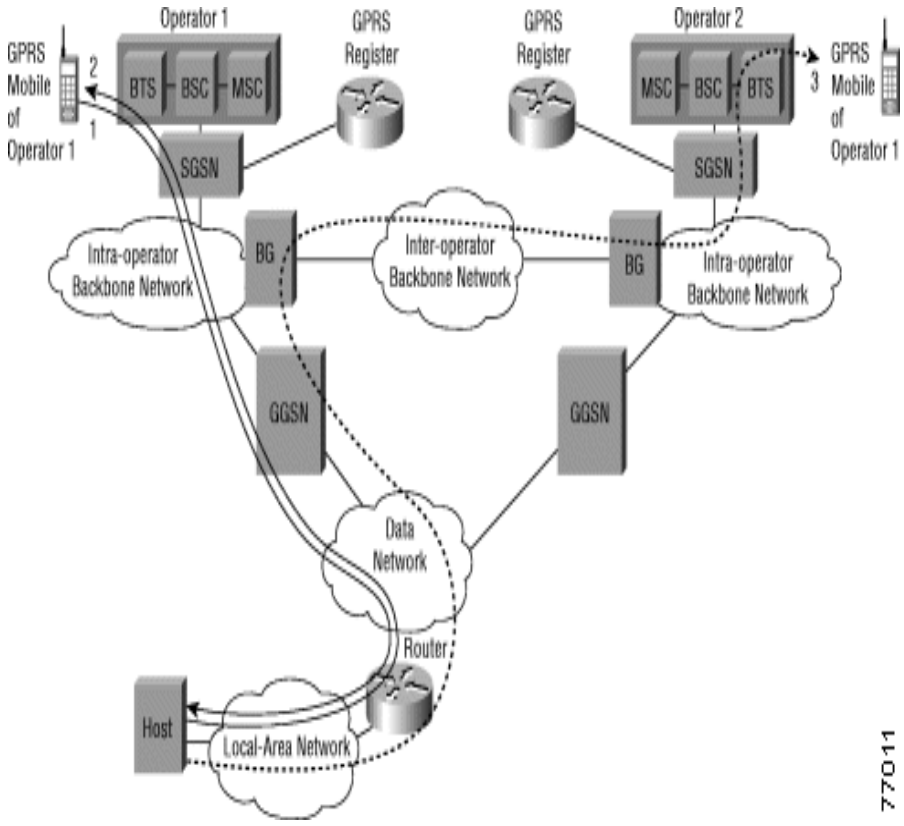
Subject: Mobile Computing **Subject Code: 17632**

	(c) **Ans.**	**Explain UI Layouts available in Android environment.** ***(Note: Any other UI layouts in android environment)*** **Linear Layout:** Linear Layout is a view group that aligns all children in a single direction, vertically or horizontally. **Relative Layout:** Relative Layout is a view group that displays child views in relative positions. **Table Layout:** Table Layout is a view that groups views into rows and columns. **Absolute Layout:** Absolute Layout enables you to specify the exact location of its children. **Frame Layout:** The Frame Layout is a placeholder on screen that you can use to display a single view. **List View:** List View is a view group that displays a list of scrollable items. **Grid View:** Grid View is a V(d)iew Group that displays items in a two-dimensional, scrollable grid.	**4M** ***Any 4- 4M***
	(d) **Ans.**	**Explain Location update for a inter LA movement.** The MS moves from LA1 to LA2, where both LAs are connected to the same MSC **Step 1.** A location update request message is sent from the MS to the MSC through the BTS, include the address of the previously visited LA, MSC, and VLR. In this ,the addresses of previous MSC & VLR are same as those for the new MSC & VLR. TMSI is used to avoid sending the IMSI on the radio path. TMSI is temporary mobile subscriber identity of the MS.	**4M**

		This temporary identity is allocated to an MS by the VLR at inter VLR registration, and can be changed by VLR after every call setup   **Step 2:** The MSC forwards the location update request to the VLR by a TCAP message, MAP_UPDATE_LOCATION_AREA The message includes • Address of the MSC • TMSI of the MS • Previous location area identification (LAI) • Target LAI **Step 3 and Step 4.** • MSC updates the LAI field of the VLR record, and replies with an acknowledgment to the MS through the MSC	***Diagram 1M*** ***Algorithm 1M*** ***Procedure 2M***

SUMMER – 2019 EXAMINATION
MODEL ANSWER

Subject: Mobile Computing **Subject Code: 17632**

	(e) Ans.	**Describe routing of packets in GPRS in detail.**  The GPRS is an enhancement over the GSM and adds some nodes in the network to provide the packet switched services. These network nodes are called GSNs (GPRS Support Nodes) and are responsible for the routing and delivery of the data packets to and form the MS and external packet data networks (PDN). The most important network nodes added to the existing GSM networks are: • SGSN (Serving GPRS Support Node). • GGSN (Gateway GPRS Support Node). Assume 2 intra – PLMN backbone networks of different PLMN. Intra – PLMN backbone networks connect GSNs of same PLMN or the same network operator. These are private packet based networks of the GPRS network provider.	**4M** ***Diagram 2M*** ***Description 2M***

		These intra PLMN networks are connected to inter PLMN backbone An Inter PLMN backbone network connects GSNs of different PLMNs & Operators To install such a backbone , a roaming agreement is necessary between 2 GPRS network providers A GPRS mobile station located in PLMN1 sends IP packets to a host connected to the IP network (Web server connected to IP n/W) The SGSN encapsulates the IP packets coming from mobile station, examines the PDP contexts and routes them through the intra – PLMN GPRS backbone to the GGSN. The GGSN decapsulates the packets and sends them out on the IP network. Using IP routing mechanisms, packets are delivered to the host through Router An IP address has been assigned to the mobile by the GGSN of PLMN 2. Thus the MS's IP address has the same network prefix as the IP address of the GGSN in PLMN2. The GGSN encapsulates the incoming IP packets and tunnels them through the inter- PLMN GPRS backbone to the appropriate SGSN in PLMN 1. The SGSN decapsulates the packets and delivers them to the MS The HLR stores the user profile, current SGSN address and PDP addresses for every GPRS user in PLMN.	